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# FIRE CONTROL HANDBOOK

## REGION 5

by

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FOREST SERVICE

S. B. SHOW, Regional Forester

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## ERRATA

### GUARD SECTION:

- P. 112, 3rd line under 5 *for* desired, *read* desire.
- P. 121, 4th line under "Uniforms," *for* EC *read* CCC.
- P. 122, first word in parenthesis under definition of Azimuth Circle, *for* gradauted *read* graduated.
- P. 136, last line under sketch *for* taper *read* taper.  
last line under sketch *for* scrapping *read* scraping.
- P. 155, second line under Report Forms used by Guards, *for* form *read* forms.
- P. 37, in last line in legend of sketch 28, *for* heigth *read* height.

### GENERAL SECTION:

- P. 22, first word under 3, *for* estimates *read* estimate.
- P. 55, sixth line under Jobs for Fire Boss, *for* communications *read* communication.
- P. 80, third line under Guard Training, *for* position *read* positions.
- P. 164, last word in parenthesis following heading "Culture," *for* Hatcher *read* Hachure.
- P. 140, last figure under instructions for Column 26, *for* and 26 *read* and 25.



# PART I

## Guard Section



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# BACKGROUND AND PURPOSE OF THE HANDBOOK

The Handbook has drawn its material from the experience of hundreds of men on thousands of fires suppressed during the past quarter century in Region 5. The authors have analyzed this wealth of experience and have codified those practices that have stood the test of time.

Fire control is a job requiring accurate selection of the practices shown by experience to be most effective in meeting particular problems. It is in every sense a professional job, in which thorough knowledge of methods and practices is essential. The Handbook undertakes to set forth the practices useful to the forest guard.



## HOW TO USE THE GUARD HANDBOOK

1. The makeup of the Handbook is intended to make it convenient for use in the field. Don't file it; keep it with you.
2. Study first the Table of Contents to get clearly in mind the structure of the Handbook.
3. Select and study thoroughly a few problems in First Attack, Back-firing, Care of Tools, Public Contact, etc. Visualize the Handbook problem in country you know, on a fire you have fought, or in situations you have encountered.
4. Try using the Index so that you can learn how to find readily particular problems you want to look up.
5. Check through Index to find under what words particular problems are listed.
6. Select one subsection, such as First Attack, and study straight through. Continue as under Paragraph 3 above to refer to country, actual fires and situations you know. Think of the Handbook in terms of your own job.
7. Try to master the problems, so you know them thoroughly. Don't try to memorize detailed material, such as Guard's Weekly Check List; use the Handbook for reference only.
8. Look up in Glossary unfamiliar words and terms as you run across them.
9. Study the sections in the Appendix as you encounter references to them.
10. Copy or insert local instructions in appropriate place in Handbook.

# SUPPRESSION OF SMALL FIRES

## FOREWORD TO THE READER

The guard, on reaching a fire, is presumed to know that Forest Service policy calls for:

1. Prompt, aggressive suppression action on all fires.
2. Use of his full energies.
3. Staying with the fire until it is out unless relieved by superior authority.

This section of the Handbook makes no attempt to teach or instruct in such fundamentals.

What it does attempt is:

1. To depict small fire suppression problems which the guard commonly meets. Each problem covers one simple, readily identified situation.
2. To indicate the action required to solve each problem.
3. To state why the solution is correct.
4. To indicate when the same solution applies to other conditions than those assumed.

Study of the problems should help the guard to establish the habit of first looking at the fire as a whole; second, analyzing it into parts; and third, deciding on and using methods of proven worth in meeting each element.

The section cannot, and does not attempt to instruct a guard how to plan a campaign, when confronted by a multiplicity of problems requiring big fire organization. That is, it will not train him to be a fire general. It should, however, aid him in deciding what immediate action will be most effective and in determining what must guide his subsequent action, when he can't tackle all the problems at one time.

## SUPPRESSION PROBLEMS AND PRACTICES

Suppression of small fires meets the same kind of problems and uses the same kind of practices as larger fires. Most effective handling of small fires involves successive steps, each with its own problems. The Handbook is concerned with outlining these steps, illustrating by means of problems.

### SIZING UP THE FIRE

This is the first problem met. Specific things to do include:

1. Go around the fire, or see directly the entire edge.
2. Size up quickly the effect on present and future burning conditions and rate of spread of:



Fuel burning adjacent to fire edge, particularly snags and logs, dead wood, brush and moss-covered trees.

Fuel in immediate path of fire.

Topography (general).

Slope.

Wind.

Relative humidity.

Time of day.

Season of year.

3. Identify sections where fire is most likely to spread quickly into bad cover.
4. Look for spot fires and if found, decide if they need action first.
5. Decide which is the most vital point of attack and begin work.
6. During size-up and corralling, decide if fire is man-caused; if so, look for and preserve evidence.

## **SELECTING POINT FOR FIRST ATTACK**

After a quick size-up of conditions within the fire and in the surrounding country toward which the fire is spreading, the basis for action is laid.

## **WHAT TO DO IN FIRST ATTACK ON EVERY FIRE**

The universal rules are:

1. Select key point of first attack, and start action.
2. Stay with the fire; depend on follow up; send a messenger or radio only if help does not arrive within reasonable time.
3. Continue work day or night.

## **PROBLEMS IN FIRST ATTACK**

Except as specified for individual problems, the following conditions are assumed for all problems in First Attack, Line Location, etc.

1. Attacking force consists of one man or small crew.
2. Suitable hand tools and back pack pumps needed are available, but not tank trucks, horse and plow, or trail-builders.
3. Normally bad, mid-season fire conditions exist. Logs, snags, etc., ignite easily and burn readily.
4. Time of day: Noon to mid-afternoon.
5. Dirt readily obtainable.

**Problem 1: Small hot fire burning in heavy fuel.**

### *Action required*

Throw dirt on flaming fuel (usually at base) to cool fire, then encircle with line at edge of fire.

### *Why*

Permits corral of fire with minimum amount of line and with max-



imum speed. Minimizes danger of spot fires and does away with clean burning job.

### *Supplemental*

Water is often more effective than dirt. In light cover, fires may be beaten down with a pine bough or other flail. Dirt is most effective when applied rapidly. If it is difficult to obtain, build up a small pile and then apply rapidly.

### **Problem 2: Fire in base of snag, not thoroughly established.**

#### *Action required*

Extinguish fire promptly in snag by use of dirt or water supplemented by scraping or chopping out burning material with shovel or axe.

#### *Why*

To prevent fire from enveloping snag and showering sparks into unburned area, thus causing spot fires, or increasing area necessary to include within line.

### *Supplemental*

The same solution applies to down logs in which fire is just getting a start.

### **Problem 3: Fire established in snag above base.**





### *Condition*

Continuous fuel all around snag. No wind. Fire in snag burning briskly ; too hot or too dangerous to fall snag. Level ground.

### *Action required*

Remove fuel from around snag (including cutting and removal of growing brush or reproduction) for a radius sufficient to catch falling limbs or chunks. Then drop back to  $1\frac{1}{4}$  to  $1\frac{1}{2}$  times height of snag, clear wide line, select time and burn out inside line to catch snag itself when it falls.

### *Why*

To prevent falling burning material or the falling snag from spreading fire to surrounding area, and to prevent spot fires.

### *Supplemental*

Same problem exists if there is wind, or snag stands on a slope. Clearing and burning inside line would then extend further from base of snag.

## **Problem 4: Fire in top of snag.**

Refer to sketch No. 1 for Problem 3.

### *Condition*

Fuel in moderate quantity surrounding snag. Light wind. Snag burning in top ; snag can be felled. Level ground.

### *Action required*

Remove fuel from area large enough to catch snag, and then *fall the snag* and extinguish all fire in it by chopping out or with water and dirt. With tall snag build line and burn out inside it.

### *Why*

To get fire on ground within reach of attacking force and to prevent spot fires.

### *Supplemental*

Similar action should be taken with spike-top tree.

## **Problem 5: Correct use of water in first attack.**

### *Condition*

Slope, cover, spread, etc., uniform. Tank truck or backpack pumps available. Hot, fast spreading fire.

### *Action required*

Use water to check fire on edge of burn ; follow immediately with clean line to mineral soil.

### *Why*

Water usually fails to extinguish fire and in most types sudden break-outs are to be expected unless held in check by a fire line.

### *Supplemental*

Only in light grass cover can water be expected to do entire suppression job.

### **Problem 6: Fire spreading, about to ignite single snag.**



②

### *Condition*

Uniform cover over area.

### *Action required*

Control edge of fire nearest snag first.

### *Why*

To prevent fire from getting into snag.

### *Supplemental*

Same solution applies where fire is spreading and about to ignite logs, dense brush, reproduction thicket or slash.

### **Problem 7: Fire about to crown in reproduction or brush.**

### *Action required*

Throw dirt at base of fire to cut down heat and prevent crowning, even if burning material is well within planned control line.

### *Why*

To reduce spot fire danger, rate of spread, and possible loss of line.



### *Condition*

Continuous fuel all around snag. No wind. Fire in snag burning briskly ; too hot or too dangerous to fall snag. Level ground.

### *Action required*

Remove fuel from around snag (including cutting and removal of growing brush or reproduction) for a radius sufficient to catch falling limbs or chunks. Then drop back to  $1\frac{1}{4}$  to  $1\frac{1}{2}$  times height of snag, clear wide line, select time and burn out inside line to catch snag itself when it falls.

### *Why*

To prevent falling burning material or the falling snag from spreading fire to surrounding area, and to prevent spot fires.

### *Supplemental*

Same problem exists if there is wind, or snag stands on a slope. Clearing and burning inside line would then extend further from base of snag.

## **Problem 4: Fire in top of snag.**

Refer to sketch No. 1 for Problem 3.

### *Condition*

Fuel in moderate quantity surrounding snag. Light wind. Snag burning in top ; snag can be felled. Level ground.

### *Action required*

Remove fuel from area large enough to catch snag, and then *fall the snag* and extinguish all fire in it by chopping out or with water and dirt. With tall snag build line and burn out inside it.

### *Why*

To get fire on ground within reach of attacking force and to prevent spot fires.

### *Supplemental*

Similar action should be taken with spike-top tree.

## **Problem 5: Correct use of water in first attack.**

### *Condition*

Slope, cover, spread, etc., uniform. Tank truck or backpack pumps available. Hot, fast spreading fire.

### *Action required*

Use water to check fire on edge of burn ; follow immediately with clean line to mineral soil.

### *Why*

Water usually fails to extinguish fire and in most types sudden break-outs are to be expected unless held in check by a fire line.

### *Supplemental*

Only in light grass cover can water be expected to do entire suppression job.

### **Problem 6: Fire spreading, about to ignite single snag.**



②

### *Condition*

Uniform cover over area.

### *Action required*

Control edge of fire nearest snag first.

### *Why*

To prevent fire from getting into snag.

### *Supplemental*

Same solution applies where fire is spreading and about to ignite logs, dense brush, reproduction thicket or slash.

### **Problem 7: Fire about to crown in reproduction or brush.**

### *Action required*

Throw dirt at base of fire to cut down heat and prevent crowning, even if burning material is well within planned control line.

### *Why*

To reduce spot fire danger, rate of spread, and possible loss of line.



### *Supplemental*

Same effect can be obtained by use of water.

**Problem 8: Fire on both sides of ravine, one head markedly larger than the other.**



③

### *Condition*

Uniform conditions of cover, slope and spread.

### *Action required*

Control smaller head of fire first; then start control of other head.

### *Why*

To hold fire to one side of ravine.

### *Supplemental*

The same solution applies to cases where separate fires are burning on each side of ravine, or where a single fire is just reaching or threatening to cross, or where fire is burning on both sides of a road or similar barrier.

**Problem 9: Fire nearing crest of ridge—danger of rolling material carrying fire down on other side is imminent.**

### *Condition*

Uniform cover, spread, etc. Topography steep. Pine cones, and other fuels capable of carrying fire by rolling.

### *Action required*

Attack first at crest.

### *Why*

To prevent ignition of fuel which would roll into unburned area, and hold fire to one slope.



### **Problem 10: Burning log lying along the contour of the slope.**

Refer to sketch No. 42 under Mop-up Problem 6.

#### *Condition*

Steep country, good soil. Water not available.

#### *Action required*

Turn log around to lie up and down hill, roll it into prepared trench. If log is then too hot, cool it down temporarily with dirt. Let it burn out rather than try to bury it.

#### *Why*

To prevent the rolling of burning material down the slope, and excessive production of sparks. It is impossible with reasonable effort to bury large logs deep enough to smother out the fire. Buried logs burn through dirt covering later and are likely to spark out and cause spots over the line after they are left as out.

#### *Supplemental*

If log is too heavy or too rotten to handle, dig deep trench below it.

### **Problem 11: Line around fire but unburned material between line and ragged edge of fire.**



④

#### *Action required*

Burn out the material, preferably by burning back from the fire line.

#### *Why*

To remove the danger of the fire flaring or spotting across line.

#### *Supplemental*

A fire is never controlled until burned back from the fire line clean.



for at least spotting distance. Where clean burning is impracticable, as it is sometimes in brush types, fuel should be cut and removed.

**Problem 12: Lower edge of fire lying along the contour of a steep slope.**  
Refer to sketch No. 23 for Line Construction Problem 4.

*Condition*

Considerable material that rolls readily, such as pine cones.

*Action required*

Construct a deep trench well banked with earth on its lower side along the entire undercut portion of the line on which rolling material can be anticipated.

*Why*

To catch and prevent the rolling of burning material across the control line into unburned territory.

**Problem 13: Rapidly spreading fire in needles, bear clover or similar cover.**

*Action required*

Use scratch line only to make first check of fire, completing line after rapid spread is stopped.

*Why*

To permit corral of fire when building of safe final line in one operation cannot keep pace with spread.

*Supplemental*

Same result can often be obtained by covering advancing edge of fire with dirt, or by use of water. In all cases it is necessary, finally, to construct a safe line and clean burn.

**Problem 14: Small fire in small dense brush patch surrounded by area where line is easily built.**





### *Action required*

Drop back from dense brush and build line in more open cover where line can be constructed rapidly. Clean burn the constructed line.

### *Why*

To encircle fire with line that can be more rapidly built and more easily held than in the brush.

### *Supplemental*

Same problem exists if fire established in localized pile of logs, slash, or dense patches of reproduction.

## **Problem 15: Fire burning near side of road, stream or other barrier.**



### *Condition*

Uniform slope and cover.

### *Action required*

First control fire on side away from barrier, allowing fire to burn to barrier or toward it until side of most threat is safe.

### *Why*

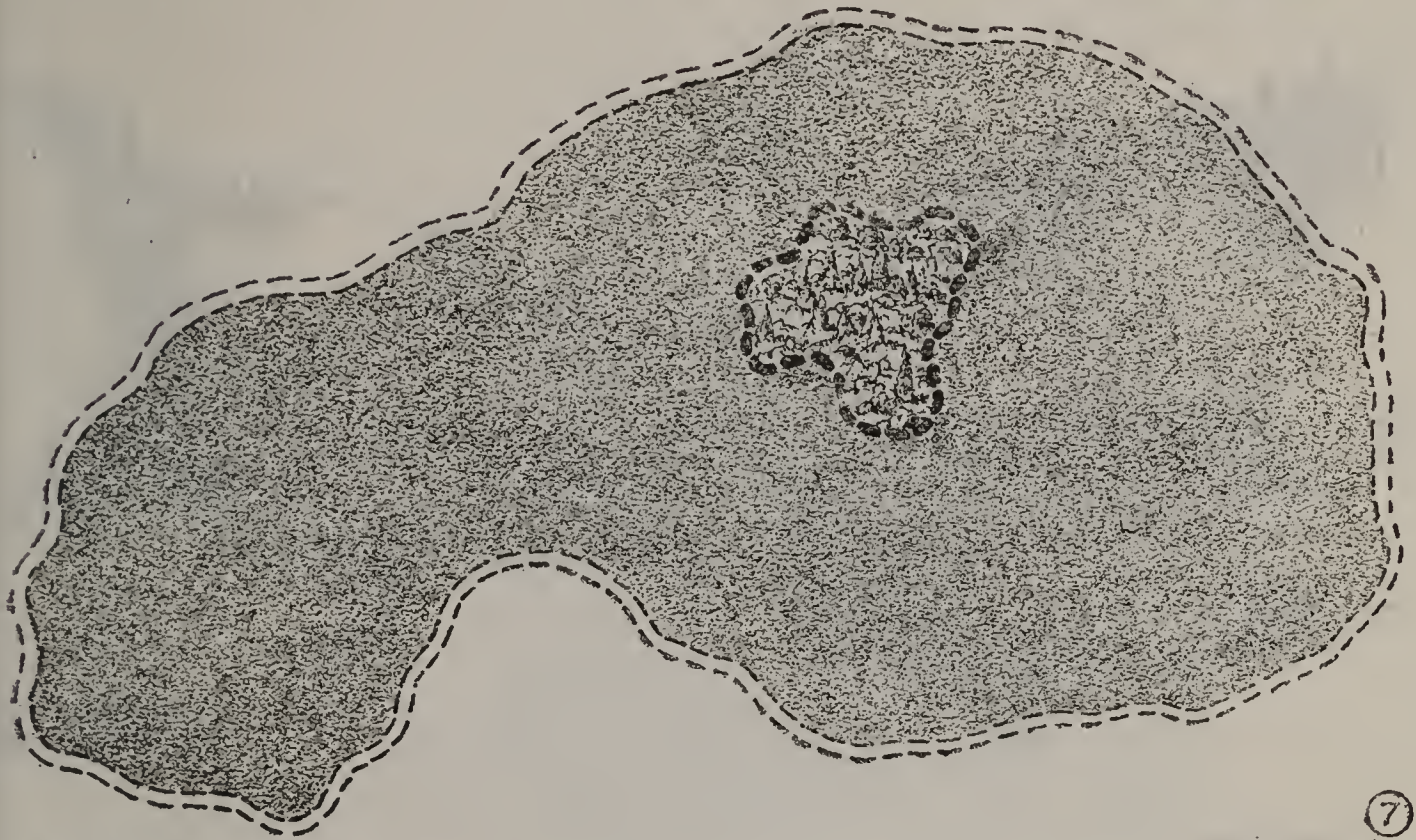
To take advantage of existing barriers and thus reduce length of line to be constructed and control time.

### *Supplemental*

It is essential that clean burning be done along existing barriers before the fire is considered controlled, unless barriers are of sufficient width to insure safety against spot fires and flaring across line.



**Problem 16: Unburned islands in a small fire, with cover heavy enough to throw spot fires.**



*Condition*

Fire did not burn heavily enough to get a clean burn and several small islands of singed brush remain within the final control line.

*Action required*

Build continuous control line around the outside of each island. If they consist of small patches of singed reproduction or brush close to the outside control line, cut these down if this can be done with reasonable expenditure of effort.

*Why*

To remove the possibility of the fire later starting up in the incompletely burned territory and spotting over the control line. To have barrier down to mineral earth around all burned territory.

**Problem 17: Small fire in lava bed country. Fire established in lava cracks.**

*Condition*

Little dirt available. Water supply several miles from fire.

*Action required*

Haul and pack water to put on fire until it is completely extinguished.

*Why*

It is impossible to build a continuous control line in this type of country so the only sure method to control is with water.



**Problem 18: Two or more lightning fires that started fairly close together are assigned to the same small crew.**



### *Condition*

Little precipitation came with the storm. Fires accurately located by lookouts' reports and three men were assigned to the job. Other fires in District made prompt follow-up unlikely.

### *Action required*

All men put corral line around one fire, then the others, to keep them from spreading, then complete control and mop-up on each fire just as soon as possible. One man remains to watch each fire until out.

### *Why*

To be sure neither fire spreads to any large size and to complete job with original labor, thus avoiding necessity of follow-up.



**Problem 19: Fire too big for first attack to control.**



*Condition*

Uniform spread, cover, etc.

*Action required*

Scout fire to have information available when follow-up crew arrives. Stay with fire. Begin work at rear of fire and proceed on rear and flanks until help arrives.

*Why*

Make time and effort effective in partial control instead of making futile efforts to head the fire.

*Supplemental*

If fire can surely be kept out of high-danger fuel, attack at such points instead of rear.



**Problem 20: Whether to protect personal property in building already doomed or to put suppression effort to prevent spread of fire.**



⑩

*Condition*

Cover, slope, spread, etc., uniform. Fire originating in building, but spreading to surrounding area.

*Action required*

Control fire, selecting key point for attack.

*Why*

To hold fire and avoid danger of major forest fire, instead of making futile efforts to save property already doomed.

**Problem 21: Protecting improvements or putting suppression effort to prevent spread of fire.**

*Condition*

Slope, spread, etc., are uniform. Fire headed toward (a) dangerous cover, and (b) toward cabin, fence or other similar property.

*Action required*

First, control key point of fire as though no improvement problem existed; then consider improvements.

*Why*

To hold fire, and avoid danger of a major forest fire.

*Supplemental*

If cover conditions are uniform and not highly hazardous and very



high improvement value is at stake, first attention to such property is justified.

## **GOOD PRACTICES IN SELECTING POINT FOR FIRST ATTACK DEVELOPED BY PROBLEMS**

1. Use water or dirt for cooling down and checking hot spots. Problems 1, 2.
2. Anticipate future control action when fire cannot be put out promptly. Problems 3, 4.
3. Follow up temporary checking effort on fire with permanent clean line. Problems 5, 13, 18.
4. Cut fire off from most dangerous fuels as first effort. Problem 6.
5. Where fire is established in explosive types of fuels, attack first to prevent it from emerging therefrom. Problems 1, 3, 4, 7.
6. Confine fire to one major area rather than to let it develop two heads. Problem 8.
7. Locate and build lines and move rollable material so that roll across fire lines is eliminated. Problems 9, 10, 12.
8. Leave neither islands nor other unburned material close to line. Problems 11, 16.
9. To insure control within time limits, sacrifice area to make easy line construction and line that can be held. Problem 14.
10. Utilize existing barriers to full extent. Problem 15.
11. Use water for final suppression when dirt not available. Problem 17.
12. If whole fire can't be controlled, make work done effective on part of it. Problem 19.
13. Protect forest area before protecting improvements. Problems 20, 21.

## **LINE LOCATION**

After both fire and territory ahead have been scouted, and key points for attack selected, the question of line location arises.

### **WHAT TO DO IN LINE LOCATIONS ON ALL FIRES**

1. Balance probable spread against probable speed of line construction.
2. Pick shortest line locations and easiest routes to expedite job.
3. Avoid sharp angles and undercut lines.
4. As far as possible, have fire back down to lines and give backfires uphill start.
5. Mark line locations.
6. Locate line as close to fire as practicable.

## PROBLEMS IN LINE LOCATION

**Problem 1: A fire burning on a moderate to steep slope.**



### *Condition*

Pine timber and scattered groups of reproduction, fire crowning only occasionally in reproduction clumps. Greatest rate of spread uphill.

### *Action required*

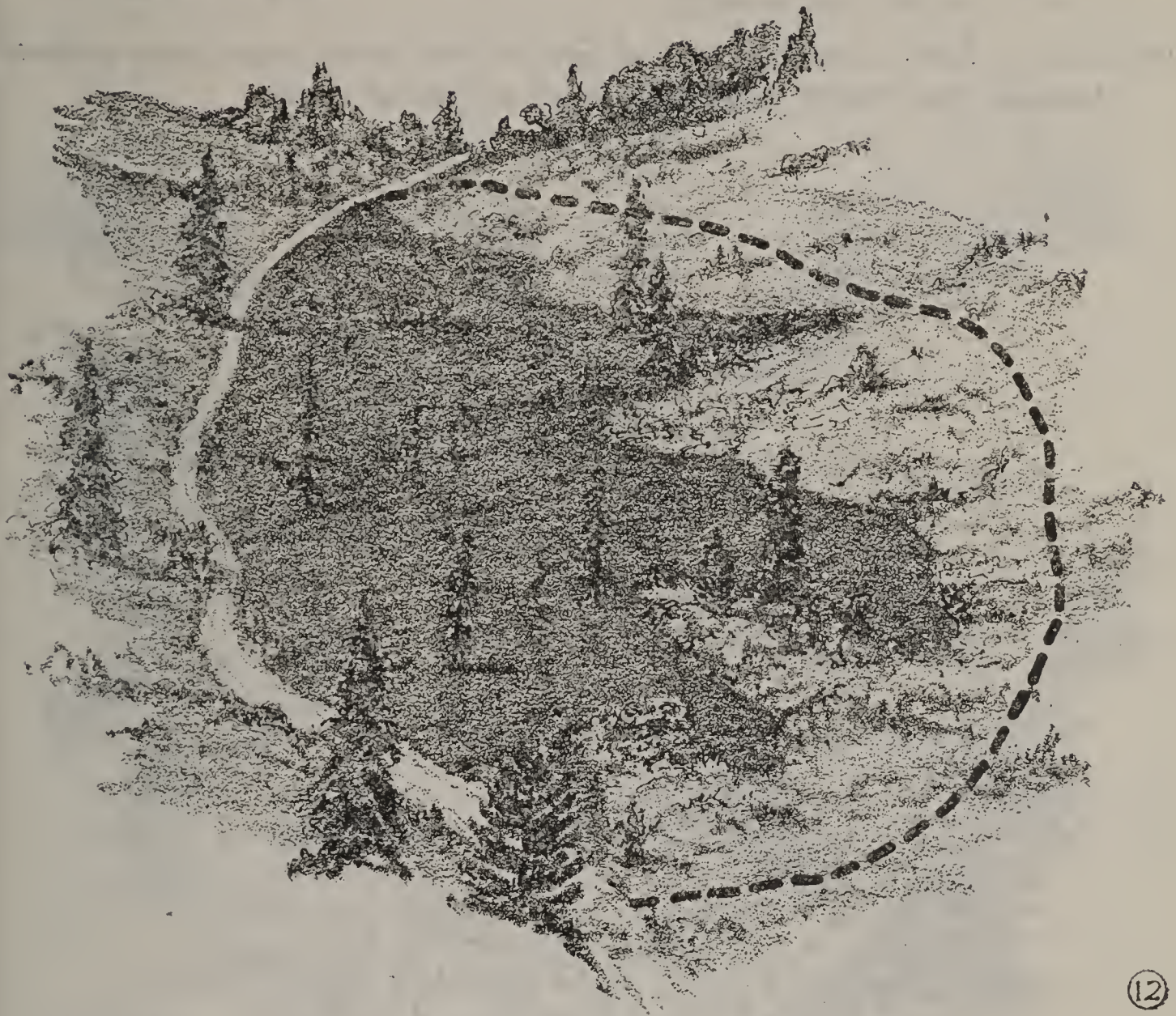
Fire should be attacked at head, then work down both sides of fire simultaneously to encircle fire at bottom. Locate line near or along edge of fire, clean burning where needed as line is built.

### *Why*

To cut off point of most rapid spread.



**Problem 2: How to locate line to control fires that spread into a series of elongated fingers.**



(12)

*Condition*

Fire has made hard run and developed long fingers with unburned area between. Fire has slowed down.

*Action required*

Tie ends of the fingers together with shortest feasible control line and burn out promptly the cover between this line and the burned area whenever :

- a. To control by direct attack the edge of the ragged burn is too large a job for available forces to complete before next burning period, or
- b. To control the burn in its irregular shape involves excessive expenditure when contrasted with the values that would be saved.

*Why*

To make control possible within the first burning period and with a reasonable expenditure of effort. The reduced length of control line will also be easier to hold.



### *Supplemental*

Same problem exists when too many spot fires develop in a limited area to control individually.

**Problem 3: How to control rear of fire on very steep slope about midway between the crest of ridge and ravine at foot of slope.**



### *Condition*

No roads or trails traverse area. Wind moderate. Fire spread fairly rapid, mainly up slope; trenching very difficult because of rock. Much fuel that will roll.

### *Action required*

Locate line at base of slope; then start at top and bring line down both sides; backfire line promptly after construction.

### *Why*

To prevent loss of line due to burning material rolling over any line constructed under the fire on the steep side hill. Location at base allows more time for construction and backfiring and can be held more easily and certainly.

**Problem 4: How to locate line to control lower flank of fire on steep ground.**



*Condition*

Cover brush or timber. Spread medium. Ravine dry. Side slopes steep. Wind has driven fire diagonally up slope.

*Action required*

Locate line on opposite side of draw from rear of fire; proceed along ravine until rolling material from head of fire cannot cross rear line; locate line up flank, converging on head of fire.

*Why*

To prevent burning material from rolling over control line.

*Supplemental*

Wide running stream may be used as line without worrying about rolling material.

**Problem 5: How existing and prospective rate of spread affects distance of control line from fire edge.**

Refer to sketch No. 4 for First Attack Problem 11.

*Condition (a)*

Fire established on moderate slope. Moderate uniform cover on entire slope. Wind direction steady. Rate of spread medium. Edge of fire fairly straight. No serious danger of rolling; wind not likely to change direction for several hours.

*Action required*

Locate line as near edge of fire as heat will permit, burning out as line built.



### *Why*

Conditions predictable far enough in advance to insure holding of line; shortest line most quickly completed by working close to fire.

### *Condition (b)*

Fire conditions as above, *except* wind gusty, sudden changes in direction, spread of fire by spurts, edge of fire irregular. Outlook: wind direction likely to switch at any moment, gustiness likely to continue.



### *Action required*

On each flank of fire, drop back to side spur or ravine far enough from fire so that, with men and tools available, entire line can be built and backfired before fire reaches any part of line. Necessary to estimate behavior of fire for definite period.

### *Why*

A tricky fire will probably cross and flank line built close to edge. Within a zone reaching out from fire edge, behavior of fire is unpredictable in detail.



**Problem 6: How to control head of fire burning up slope and nearing sharp crest of ridge.**



*Condition*

Fire running up hill rapidly in moderately dense brush or reproduction.

*Action required*

Drop just over crest of ridge away from slope on which fire is running and build line. Trench if necessary to prevent rolling material from getting over the line. Clean burn promptly after construction.

*Why*

To prevent main fire from sweeping over control line; to permit clean burning of line with initial uphill run of backfire; to provide a wide line when fire reaches crest; to create a counterdraft that will slow up main fire and cause sparks to fall back in burned area.

**Problem 7: How to locate line to control badly fingering fire nearing top of well-defined ridge, and which is not expected to reach ridge before heat of next day.**

*Condition*

Night approaching. Relative humidity increasing. Fire dying down. The ridge is between fire front and a well-defined ravine. It is impracticable to cold trail head of fire due to the numerous fingers. Humidity too high to obtain clean burn down slope. Uniform cover of brush.

*Action required*

Go to the ravine and construct control line along it but on side opposite from fire; tie in flanks and backfire uphill.



### *Why*

Location of line in ravine in preference to ridge top will result in a more thorough backfiring job, since a backfire will clean burn uphill during periods of high humidity. Location of line on side of ravine opposite from fire is necessary to prevent burning material from rolling across line.

### **Problem 8: How to locate line near snags threatened, but not yet afire.**

Refer to sketch No. 2 for First Attack Problem 6.

### *Condition*

Rate of spread moderate. Wind light. Topography level.

### *Action required*

Locate fire line to leave all snags outside the completed line.

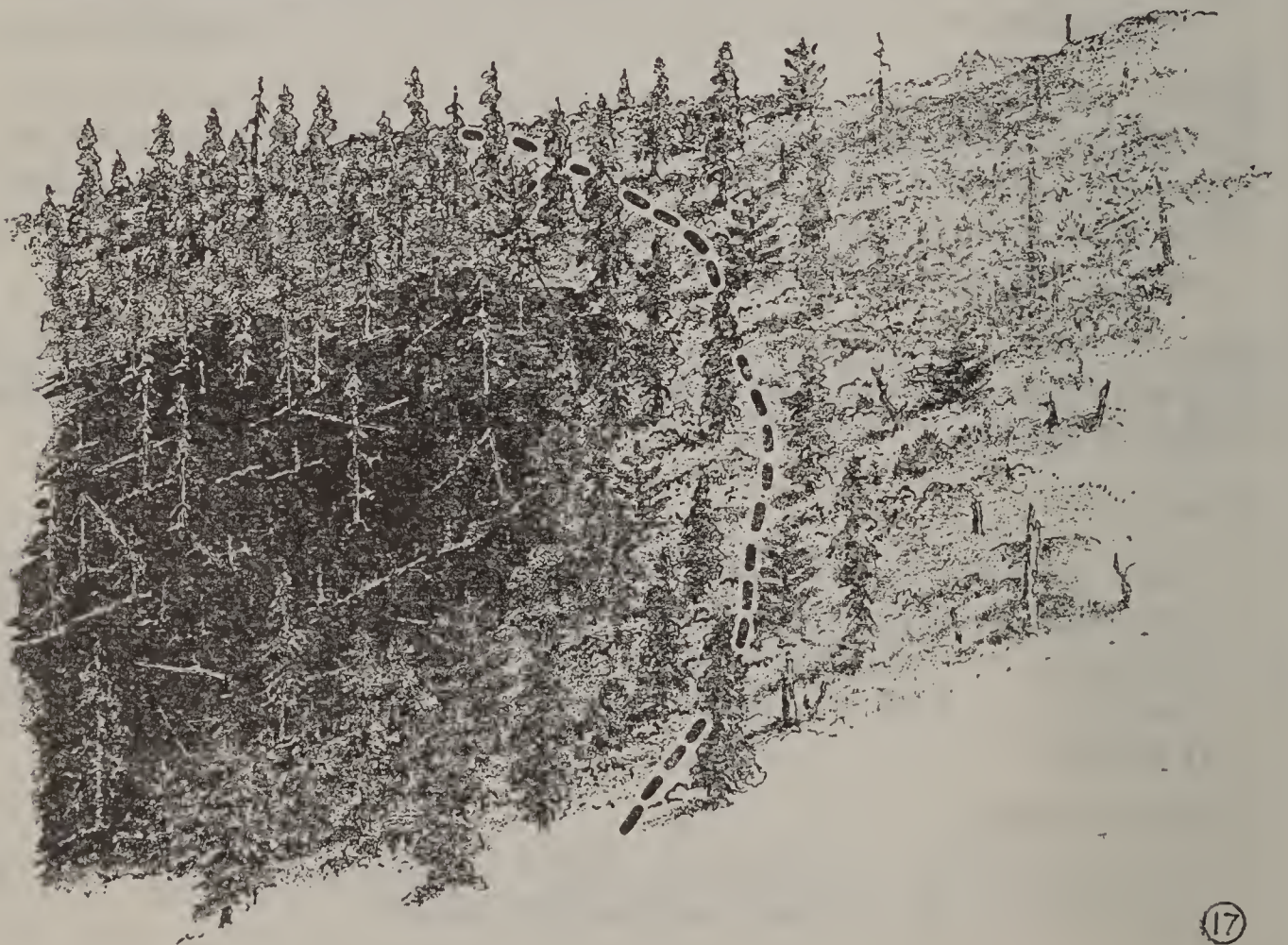
### *Why*

To keep snags from catching fire and spreading fire on ahead by burning embers or sparks.

### *Supplemental*

When snags are so close to fire edge that the main control line cannot be located to exclude them, good practice is to clear all fuel around each snag or groups of snags over a sufficient width to prevent them from igniting.

### **Problem 9: How pronounced change of cover type outside fire affects location of control line.**



### *Condition (a)*

Fire established in virgin mixed conifer type. Spread moderate. Wind direction steady. Dense brushfield with many snags and down logs some distance ahead of fire. Direct attack on head of fire impossible or dangerous.

### *Action required*

Locate line across head of fire in timber, far enough from edge of brushfield so that under existing conditions spotting into brushfield unlikely. Locate as close to fire edge as possible, leaving time to complete and backfire line.

### *Why*

Resistance to control in brushfield greater than in timber. Key point is to confine fire to timber.

### *Supplemental*

Solution is same where fire threatens to move from any type with less resistance to control to any type with greater resistance to control.

### *Condition (b)*

Fire established in dense brushfield. Moderate or rapid spread. Wind direction steady. Virgin timber type lies across head of fire. Flanks and rear of fire will remain in brush for long distance. Direct attack on head impossible or dangerous.

### *Action required*

Locate line at or just inside edge of timber type, backfiring as built if crowded for time; or when completed, if not crowded. Locate line for rear and flanks in brushfield as governed by heat of fire, topography, and rate of spread.

### *Why*

Attempt to control head of fast moving fire in high-resistance type dangerous and ineffective. Select location where best chance for success, without needless sacrifice of area or values.

### *Supplemental*

Same solution applies to fire which is headed from any high-control resistance type to any type of lower control resistance.

**Problem 10: How to locate line with reference to burning snags inside fire, too hot to cut down.**

### *Condition*

Topography level. Wind light. Rate of spread moderate.



### *Action required*

Locate line far enough from fire to catch blowing sparks and embers coming from burning snags, and snag itself when it falls or is cut. Maintain constant watch for spot fires.

### *Why*

To prevent loss of line caused by embers blowing into unburned area, or by the snag falling.

## **Problem 11: How heat of fire affects distance of control line from fire edge.**

### *Condition (a)*

Small fire established in large slash area. Road near flank will not automatically stop fire but can be held. Heat uncomfortable but not unbearable for few minutes at a time.

### *Action required*

Use dirt and water to cool down fire at edge of road, using individual workers very short period at a time.

### *Why*

Facing hot fire necessary to prevent major fire involving whole slash area. No danger to life, since ways of escape open. Utilizes existing barrier.

### *Supplemental*

Same solution where necessary to keep hot fire from getting into high-resistance type, or to save structures.

### *Condition (b)*

Fire established in large, dense brushfield, full of down logs. No barrier near fire edge. Night time. Rate of spread slow, but volume of heat great.

### *Action required*

Locate line beyond zone of intense heat, but close enough to minimize length of line.

### *Why*

Nothing to be gained by making work needlessly uncomfortable.

### *Supplemental*

Same problem with any slow spreading, but very hot fire, where key problem is sureness rather than speed of control.

**Problem 12: How to locate lines with reference to natural or man-made barriers.**



*Condition*

Fire burning just above canyon in steep country. On one spur leading to canyon is a trail leading from the main ridge which parallels canyon; along this ridge is a series of large rock outcrops making almost a solid barrier.

*Action required*

Utilize the trail as a control line on the one side and tie the bluffs together at the top for the upper line.

*Why*

The use of existing natural or man-made barriers as parts of control line expedites the control of a fire through reducing the size of the job. Trails, roads, or firebreaks usually make easier and safer lines to patrol.



**Problem 13: How to locate lines to control narrow head of fire, too hot for direct frontal attack.**



***Condition***

Rapid rate of spread up steep slope; uniform cover of mature pine; considerable young growth.

***Action required***

Locate and construct line around head of fire, avoiding sharp angles.

***Why***

When there is a sharp bend in a line around the head of a hot fire, danger of spotting is increased greatly, since the intensity of the fire is concentrated at a point instead of being distributed along a wider front. Also, wind from any direction will tend to blow the fire over some portion of the line in the vicinity of the sharp angle.

***Supplemental***

Line location along trails, roads, ridges, streams, etc., involving sharp angles, should likewise be avoided.



**Problem 14: How to locate line in country of varied cover and topographic conditions.**



20

*Condition*

Fire burning in steep, rugged country with occasional open ridges interspersed with heavily timbered canyons and brushy slopes.

*Action required*

Locate line on most open and smoothest ridge or canyon within practicable distance of fire considering its probable rate of spread. Avoid heavy cover and ridges so rough as to make line construction **slow and difficult.**

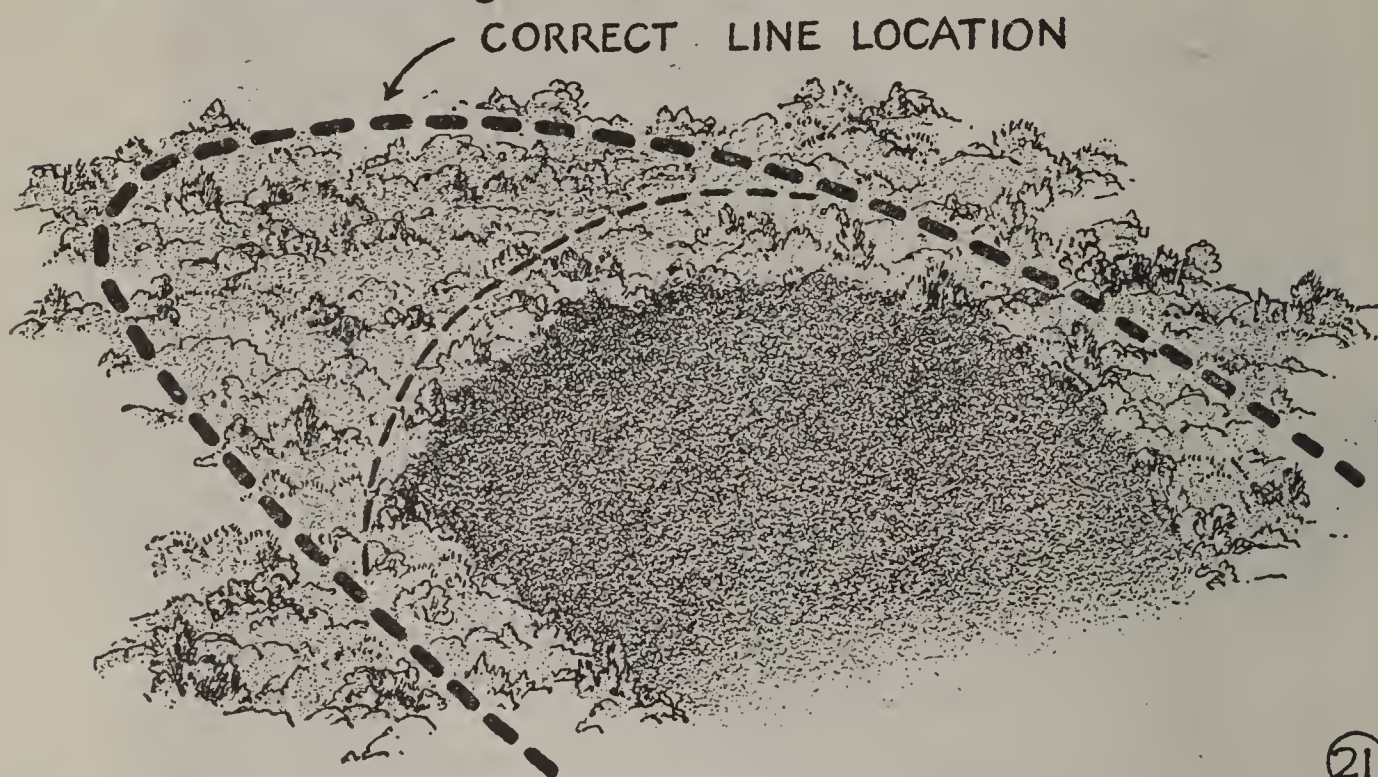
*Why*

To facilitate the construction and holding of the line with the min-



imum of effort and the maximum of possibility of success; to obtain sureness of control even at a possible sacrifice of area.

**Problem 15: How to locate line to control fire moving forward along a uniform front burning too hot for close frontal attack.**



*Condition*

Uniform dense brush cover. Level ground. No topographical features, such as ridges and ravines, to influence location of line. Fire any size. Rate of spread rapid and expected to continue.

*Action required*

Locate line a sufficient distance ahead of the fire front so that there is ample time to build and backfire before the front of the fire reaches it. Locate the line at an angle to axis of fire spread, so that only a small portion of main front will hit line or backfire during any given short period.

*Why*

To reduce the size of the fire front that must be stopped by the control line at any given time.

**Problem 16: How to take advantage of normal shift of wind direction in canyons.**

*Condition*

Early evening. Hour of day approaching for normal shift of wind from up-canyon to down-canyon draft. No extreme conditions of cover or weather. Fire in broad canyon. Fire can be controlled without difficulty with forces available before midnight.

*Action required*

Locate line for first work at rear or down-canyon side of fire out of

heat and smoke. Work around both flanks of fire closing in on up-canyon side when the wind shifts to down-canyon draft.

### *Why*

Successively working sections of the fire while they are quiet permits more effective production of line by allowing men to work under conditions of minimum heat and smoke; and permits line to be more easily held. Line first worked has cooled down and requires minimum attention to prevent loss when the wind shifts to down-canyon direction. The portion of fire which was the head on arrival becomes the rear when the wind shift occurs and attack at this time is more easily made.

## **GOOD PRACTICES IN LINE LOCATION DEVELOPED BY PROBLEMS**

1. Locate line as near fire edges as possible. Problem 1.
2. Make line as short as possible. Problem 2.
3. Locate fire line so rolling material cannot cross. Problems 3 and 4.
4. Where fire is spreading rapidly or is very hot, or when gusty, shifty wind makes direct attack uncertain, locate line to give time for line construction and backfiring. Problem 5.
5. Locate lines to give uphill start to backfiring. Problems 6 and 7.
6. Block off high hazard types where possible by leaving outside of lines. Problems 8 and 9.
7. Locate lines far enough from burning snags to enclose snags when felled and to catch sparks. Problem 10.
8. In high hazard types, locate line close to fire edge even when very hot where men can work safely for short periods. Problem 11a.
9. Under similar conditions where men cannot work safely, back up to leave time for line construction and backfiring. Problem 11b.
10. Capitalize on all existing barriers in line locations. Problems 11a and 12.
11. Avoid sharp angles in line. Problem 13.
12. Select most open locations. Problem 14.
13. In country without definite topographic features use oblique lines for frontal attack. Problem 15.
14. Take advantage of normal daily shift between up-canyon and down-canyon drafts. Problem 16.

## **LINE CONSTRUCTION**

### **THINGS TO DO ON ALL FIRES**

1. Make line no wider than necessary.
2. Clean all lines to mineral soil for all or part of width.
3. Dispose of material so as not to interfere with mop-up.



4. Protect undercut lines against rolling material.
5. Continue work day or night.

## PROBLEMS IN LINE CONSTRUCTION

### **Problem 1: How to dispose of material removed in line construction.**

#### *Condition (a)*

Work is done directly on the fire edge because it is spreading slowly.

#### *Action required*

All blackened or charred material should be scraped into the burned area; whatever is cut or scraped away on the portion of the line outside of the burn should be put on the outside of the line. The charred fuel should be scattered in the burn and not covered with dirt.

#### *Condition (b)*

Line constructed some distance away from the edge of the fire.

#### *Action required*

If the removed cover is light, it should be thrown whichever way will make for most rapid line construction, care being taken not to build up heavy piles of fuel inside of the line and close thereto. If the fuel is needed in backfiring, it should be placed inside the line.

#### *Why*

To avoid building up the supply of fuel close to the line with consequent increased danger of the fire getting across; to dispose of material in easiest way.

### **Problem 2: How to use relatively narrow line to speed control.**

Refer to sketch No. 34 for Backfiring Problem 6.

#### *Condition (a)*

Line narrower than desirable through seedling reproduction, which must be backfired or to which fire will back. Considerable danger of spotting or flaring over line.

#### *Action required*

Throw dirt or use water to keep fire out of crown immediately adjacent to line.

#### *Why*

To reduce intensity of burning and to minimize danger of spotting or crowning over line.

#### *Supplemental*

Same problem if brush, sage, or buckwheat involved.

#### *Condition (b)*

Down log or stump inside fire near line. Danger of spotting or rolling.



### *Action required*

If already afire, cool down with dirt or water. If not afire, try to keep fire out with temporary line.

### *Why*

To gain time until special attention can be given to eliminate threat.

### **Problem 3: Protecting most inflammable fuels outside fire line.**

Refer to sketches Nos. 43 and 44 for Mop-up Problems 9 and 10.

### *Condition*

Fire close to rotten stumps, snags or logs. Main fire throwing spots.

### *Action required*

Use dirt or water on material outside line to minimize danger of spots.

### *Why*

Such fuels most dangerous focal point for spot fires.

### **Problem 4: How to trench.**





### *Condition*

Fire backing down moderate slope in needles, cones and scattered wood fragments ; undercut line needed ; dirt available.

### *Action required*

Convert fire line into a trench by excavating clean mineral soil and piling along lower edge. Duff may be used to form part of berm but should be completely covered with mineral soil.

### *Why*

To catch rolling, flaming material.

**Problem 5: How to build trench to handle rolling material in rocky country.**



(23)

### *Condition*

Fire on steep rocky slope, with material that will roll when disturbed by fire, and undercut line necessary.

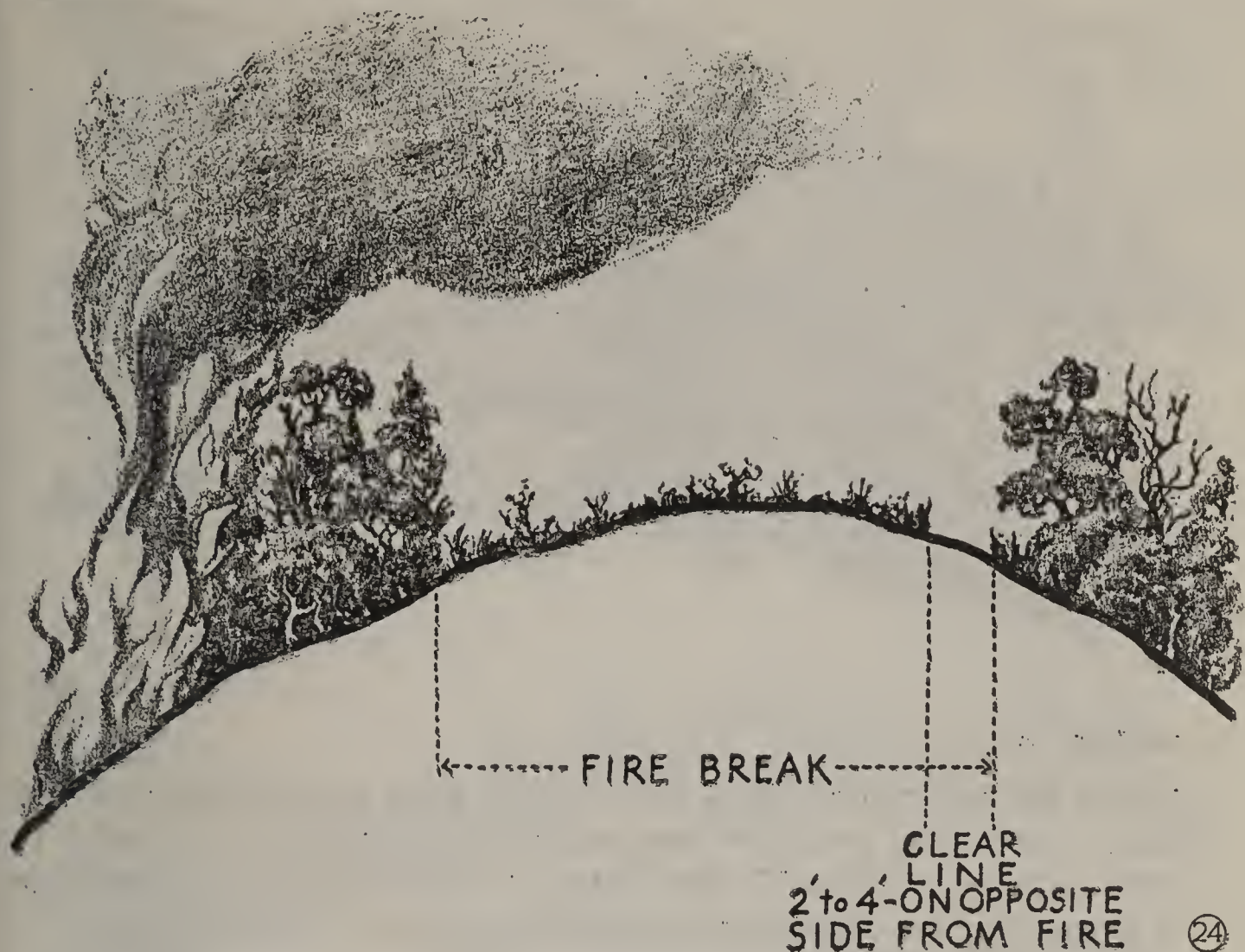
### *Action required*

Convert fire line into trench as in previous problem, using stones, small logs, or other debris to form foundation of berm. Cover face with mineral earth. If necessary use trees, stakes or stones to hold logs in place.

### *Why*

To build effective barrier against rolling material faster than is possible with dirt alone.

## Problem 6: Effective use of firebreak.



### *Condition*

Firebreak to be backfired. Light cover of grass and weeds on break.

### *Action required*

Before backfiring, clear fuel from break on strip two to four feet wide on edge of break away from fire.

### *Why*

To obtain full effectiveness of entire width of break.



## Problem 7: Temporary lines to check or stall fire and gain time.



### *Condition (a)*

Major fire has run up steep heavy brush slope and has slopped over crest in stringers and spots too ragged and numerous to control by direct attack. Considerable time needed to prepare line at base of slope in advance of fire and await favorable conditions for backfiring.

### *Action required*

Hot spot threatening stringers and spots to check them while constructing backfire line.

### *Why*

To gain time for construction and permit selection of time for backfiring.

### *Condition (b)*

Fire line will leave snags inside but close to line. Danger of spotting great if they catch and time insufficient to fall snags.

### *Action required*

Build temporary lines around individual snags or groups of snags.

### *Why*

To guard against spot fires and other snag dangers until time can be gained for final control.

### *Condition (c)*

Fire in squaw carpet or bear clover. Forces available insufficient to construct final control line at once.



### *Action required*

Put in scratched line. Later, when main fire is controlled, strengthen scratched line or build new and final line if first line lost.

### *Supplemental*

Generally unburned hazards inside lines will be immediately disposed of, but when crowded for time on initial attack "stalling" is good practice.

**Problem 8: Supplemental and alternate lines for use only if main fire line is lost.**



### *Condition (a)*

Rotten down logs near but outside line which have not but may catch fire. Too large to cover with dirt, and water not available.

### *Action required*

Build line back of log, tied in at both ends to main line.

### *Why*

Advance preparations will greatly speed control if spots in logs become established.

### *Supplemental*

Same solution if slash piles or any other extra hazardous fuel close to line which cannot be dirted or wet down.





### *Condition (b)*

Main fire line to be backfired in edge of timber to attempt holding head of fire coming out of heavy brush. Danger that impact will cause breaks in line but not simultaneous loss of large sections. Anticipated that breaks can probably be controlled as individual spots, but not certain.

### *Action required*

If labor available, drop back a few hundred feet and build second line parallel to main line. Use only in case of necessity.

### *Why*

If slop-overs and spots not controllable individually, additional area bound to be lost. This advance preparation will save critical time.

## **GOOD PRACTICES DEVELOPED BY LINE CONSTRUCTION PROBLEMS**

1. Scrape or throw burning or charred fuel into fire. Problem No. 1.
2. Dispose of material removed in line construction where it will facilitate backfiring, shorten burning period, and decrease difficulty of mop-up. Problem No. 1.
3. Effectiveness of a given width of line can be increased by using dirt or water to cool down adjacent fire, and to cover fuels on outside of fire line. Problems Nos. 2 and 3.
4. Any undercut line must be designed to protect against rolling material. Problems Nos. 4 and 5.



5. When backfiring from an existing firebreak, not clear of low fuels, obtain full effect of whole width of firebreak by backfiring from a line cleared to mineral soil on edge of break away from fire. Problem No. 6.

6. Use temporary lines to slow down fire when additional time is needed in which to construct final line. Problem No. 7.

7. To insure prompt control of fire from possible ignition of fuel outside of main control line, construct alternate lines around accumulations of particularly dangerous material. Problem No. 8.

## SPECIAL LINE CONSTRUCTION METHODS

### Cold Trailing

To cold trail is to build a line along the edge of a fire that has ceased to crown and is smoldering in duff or low ground cover. Brush or other high material is slashed, the trail is cleared to mineral earth. Ordinarily, clearing can be relatively narrow (one-half the height of the brush up to three or four feet is a good guide) and it is constructed one-half in the burn and one-half outside. All smoldering or charred brush should be thrown well back in the burn. Green brush may be thrown outside. Duff is scraped into the burn and scattered.



In cold trailing, be sure that:

1. No embers are cast into green area.
2. Charred and smoldering material (both brush and duff) are well scattered to prevent later flare up.
3. No fingers of smoldering material are overlooked.



4. Material left inside of line is so thoroughly burned that it cannot flare up; otherwise cut it out and scatter.
5. Islands of unburned or singed material are slashed and scattered, or the islands are cold trailed.
6. The trail is to mineral soil and clean of leaves, twigs and roots.
7. On undercut lines, trenches or gutters are provided if there is any chance of burned material rolling across line.

### **Hot Spotting**

Hot spotting is a practice often used in cold trailing attack (but not necessarily limited to such situations), by which small crews are sent ahead to dangerous points on the fire edge to control or check the threatened revival of spread at those points, and to knock down and hold localized flare-ups. Intermediate sections of the edge of the fire of little immediate concern are left to the cold trailing crews. In general, the problem is to hold the fire in place until control can be effected.

In hot spotting, the usual technique is the same as in cold trailing, except that it is often necessary to increase the width of line and go to extremes in the scattering of cut material to prevent revival of the fire. Often a hot spotting crew can cover effectively several hot spots by leaving behind one or more members of the crew at each spot after control is reasonably assured, to maintain safety until the cold trailing crew arrives.

### **Feeling Out**

In low and thin cover, such as the less dense stands of chamise, cold trailing need be done only on those sections of the edge of the fire at which signs of fire can readily be found. Sections that appear to be dead are not trailed, but are carefully gone over by an experienced man who feels the edge of the burn with his bare fingers to be sure that no fire is overlooked. Feeling out can save vast quantities of work but must be done by an experienced and reliable man; and the line must be checked frequently for signs of fire. It should not be relied upon, except as a temporary expedient, in areas of deep duff.

## **ADDITIONAL GUIDES TO LINE CONSTRUCTION PRACTICES**

The construction of fire lines in any fuel type, or combination of types, involves removal of burnable material from a strip wide enough, given mop-up and patrol, to prevent fire spreading beyond the fire line. It is essential that all or part of the line be cleared all the way down to mineral soil. Effective line widths vary with the volume of the fuel, that is, density and height of cover; its inflammability; the wind direction and conditions of weather and topography which influence rate of spread.

The amount and character of burnable dead or down debris and live vegetative cover determine to a large extent the rate of spread and resistance to control. Fuel types are based on the foregoing, and the ones listed in the following tables are those most generally encountered in the construction of fire lines.

The table gives general guides for the minimum and maximum line widths. The minimum is a guide applicable to the rear or other slower burning sections of a fire. The maximum is applicable where fire is spreading rapidly uphill under the most severe burning condition.

Certain tools are most suitable for speedy and safe line construction in different cover and fuel types. The best tools for such use in the several types are shown in the table. Other tools are commonly needed for work other than line construction, such as mop-up or patrol, which may be done at the same time as line construction. For example, in bear clover type, the McLeod tool is shown as most effective for line construction. But, for a crew working in this type, a shovel or two and an axe may be needed for throwing dirt or cutting out logs. But the larger part of the tools on line construction should be of the kind indicated. The number of each kind of the various tools needed to outfit crews is left to decision by Forests or Ranger Districts in accordance with local conditions of fuel and cover.

Failure to recognize and take precautionary measures against certain conditions and occurrences has often resulted in losing a line or a fire. Some of the more common dangers for which to watch when working in each fuel type are given in the final column of the tabulation of fuel types and tools.



Principal Fuel Types, Total Cleared Width, Width Cleared to Mineral Soil, Most Effective Hand Tools, and Special Danger Points in Each Type

| FUEL TYPE                        | Total Width<br>Cleared                          | Width Cleared<br>to Mineral Soil | Most Effective Hand Tools                         | Special Danger Points  |
|----------------------------------|---|----------------------------------|---|--|
| 1. Low Grass*<br>(Cheat Broncho) | None  | Beat or whip<br>out              | Wet sacks, pine bough,<br>wire broom flail        | Dried dung<br>Dead oak roots   |
| 2. High Grass<br>(Wild Oats)     | 1 - 2½  | Entire                           | McLeod  | Dried dung<br>Dead oak roots   |
| 3. Pine Needles                  | 1½ - 4 ft.                                      | Entire                           | McLeod  | Rolling cones, hollow roots,<br>dead roots, punky logs,<br>stumps                                    |
| 4. Bear Clover                   | 1 - 3 ft.                                       | Entire                           | McLeod  | Buried logs and roots,<br>punky logs and stumps  |
| 5. Squaw Carpet                  | ½ - 1½ ft.                                      | Entire                           | Pulaski, McLeod                                   | Roots in rocks<br>Rolling cones  |
| 6. Sage Brush—Grass              | 2 - 8 ft.                                       | Entire                           | Brush hook, McLeod, Axe                           | Dried dung<br>Sage roots   |
| 7. Grass, Buckwheat              | 1½ - 8 ft.                                      | Entire                           | McLeod  | Roots in rocks, spot fires<br>Rolling yuccas   |
| 8. Chamise                       | 2 - 40 ft.                                      | 2 ft. on lee<br>side of line     | Pulaski, McLeod, Brush<br>hook, Shovel            | Rolling yuccas   |
| 9. Slash                         | 4 - 20 ft.                                      | 2 to 4 ft. on<br>lee side        | Shovel, McLeod, DB Axe,<br>Saw, Sledge and wedges | Rolling chunks and cones<br>Spot fires, roots across line,<br>rolling logs, punky logs and<br>stumps |
| 10. Manzanita                    | Min. Height 2 to 4 ft.<br>of brush to<br>60 ft. |                                  | Brush hook, Axe, McLeod,<br>Shovel                | Brush stools, spot fires<br>Rolling stools, burning<br>roots   |

|   |                                      |             |  |
|---|--------------------------------------|-------------|--|
| 11. Dense Mixed Brush<br>(Including dense<br>coppice hardwood)  | Min. Height<br>of brush to<br>60 ft. | 2 to 8 ft.  | Brush hook, Axe, McLeod, Rat nests, rolling material,<br>roots, buried logs, spot fires<br>Shovel  |
| 12. Dense Seedling, Sap-<br>ling and Small poles<br>6" - 8"     | 2 - 20 ft.                           | 2 to 4 ft.  | McLeod, Axe, Shovel<br>Roots, overhanging foliage,<br>punky logs and stumps  |
| 13. Coast Type (Salal,<br>Rhododendron, Huck-<br>leberry, etc.) | 2 - 4 ft.                            | 1 to 2 ft.  | Pulaski, Axe, Shovel<br>Buried rotten roots and<br>wood  |
| 14. Old Burn, with lots of<br>snags and down logs               | 6 - 60 ft.                           | 4 to 10 ft. | Axe, Shovel, Falling saw,<br>Sledge and wedges<br>Rotten stumps and logs out-<br>side and near line, falling or<br>sliding snags, roots, spot<br>fires, rolling chunks |
| 15. Heavy duff  | 1 - 2 ft.                            | Entire      | Pulaski, Shovel<br>Buried logs, roots, etc.<br>Deceptive material which<br>looks like earth but is de-<br>cayed vegetable matter                                       |
| 16. Dense mature woodland                                       | 1½ - 4 ft.                           | Entire      | Stable broom, McLeod<br>Dead roots across line, rat<br>nests, moss on standing<br>trees, falling leaves, burn-<br>ing limbs and knot holes in<br>standing trees        |
| 17. White Thorn   | Height of<br>brush to<br>20 ft.      | 2 to 4 ft.  | Pruning shears, Shovel,<br>McLeod<br>Spot fires, rat nests, roots<br>across line, punky logs and<br>stumps   |

\*Scattered brush in grass or groups of reproduction in needles does not change the fuel type, since the problem of fire line construction remains essentially the same.

In any mature timber stand, the fuel on and near the ground determines fuel type. In any stand, snags are a special source of danger.



## **SPECIAL MACHINERY FOR FIRE LINE CONSTRUCTION**

The faster a line can be constructed around a fire the smaller the area and the less trouble in holding the fire. Trail builders and tractors can do the work of many men and can do it rapidly. Such machinery, in addition to graders, plows or drags, should be taken to fires and used on all portions of the fire perimeter where it is at all possible to use them.

Tank trucks can and should be used where available to knock down the blaze and retard spread. The use of water alone should not be depended upon in lieu of a control line except in light grass cover, but must be followed by close inspection and prompt line construction with hand or power tools to make sure the fire is surrounded and will stay out.

### **BACKFIRING**

Special problems arise in burning out between control lines and the fire.

#### **WHAT TO DO IN ALL BACKFIRING**

1. All control lines except those at edge of fire must be backfired out to be effective.
2. Where possible, start backfires on higher portion of line so operation will proceed downhill.
3. There is a best time for backfiring to be watched for, recognized and seized.
4. Chances must be taken in backfiring if fires are to be controlled within constructed lines.
5. If safety of men is assured, better to gamble on emergency backfire than to lose line to main fire.

#### **PROBLEMS IN BACKFIRING**

**Problem 1:** How to backfire when front of fire is approaching ridge.





### *Condition*

Medium brush cover, wind up slope; control line is located 100 to 200 feet over crest.

### *Action required*

Promptly set backfire along line as built even if general wind direction is opposed.

### *Why*

Line is properly located so that backfire can be started uphill and will burn against wind. Burn while humidity is low as indicated by active spread of main fire. As main fire nears crest it will create an updraft which will draw backfire toward it.

**Problem 2: Timing and aggressiveness in backfiring; identifying and acting on favorable conditions.**



### *Condition*

Fire on chaparral covered slope, with uneven edge; burning briskly up side ridges and creeping around in canyons. Firebreak on main crest; mid-afternoon wind blowing across ridge toward fire.

### *Action required*

Set backfire along firebreak as promptly and as rapidly as possible.

### *Why*

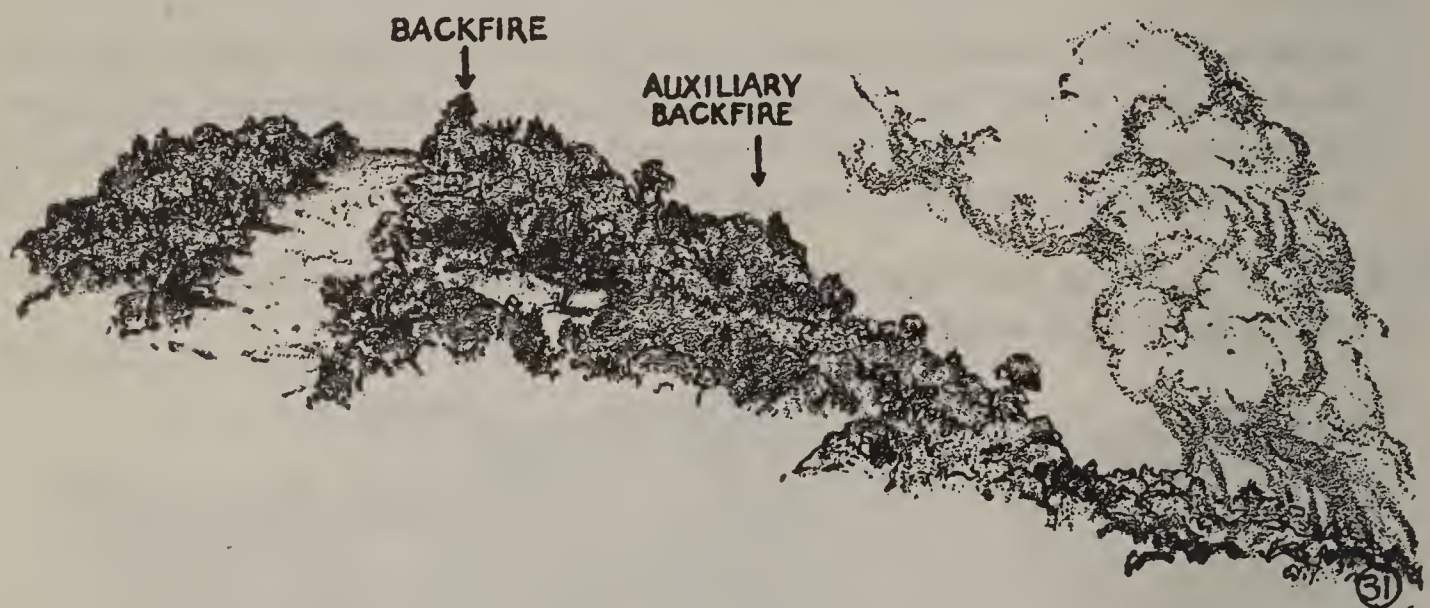
Take advantage of favorable wind and humidity condition, and push backfire aggressively to complete before wind changes and humidity increases, and fire lies down.



### *Supplemental*

Same problem exists for any type or slope when line is ready to backfire and when normal outlook is that with nightfall main fire will lie down, leaving ragged, irregular line, difficult or impossible to cold trail.

#### **Problem 3: How to backfire under adverse conditions.**



### *Condition*

Line completed at too late an hour to obtain easily a fast and clean backfire; fire along ridge in the chaparral type.

### *Action required*

Stimulate backfire by spraying oil on fuel through use of such equipment as the flame thrower. Set auxiliary fires short distance down the slope, which will burn uphill toward the line; using flame throwers if the cover is safely penetrable, bombs if it is not.

### *Why*

Necessary to backfire or face blowup of fire with probable loss of line during next burning period.

### *Supplemental*

Same situation develops because of timidity in backfiring while conditions favor ready burning.

#### Problem 4: Timing backfire to utilize suction from main fire.



##### *Condition*

Backfiring against strong wind. Any readily inflammable cover.

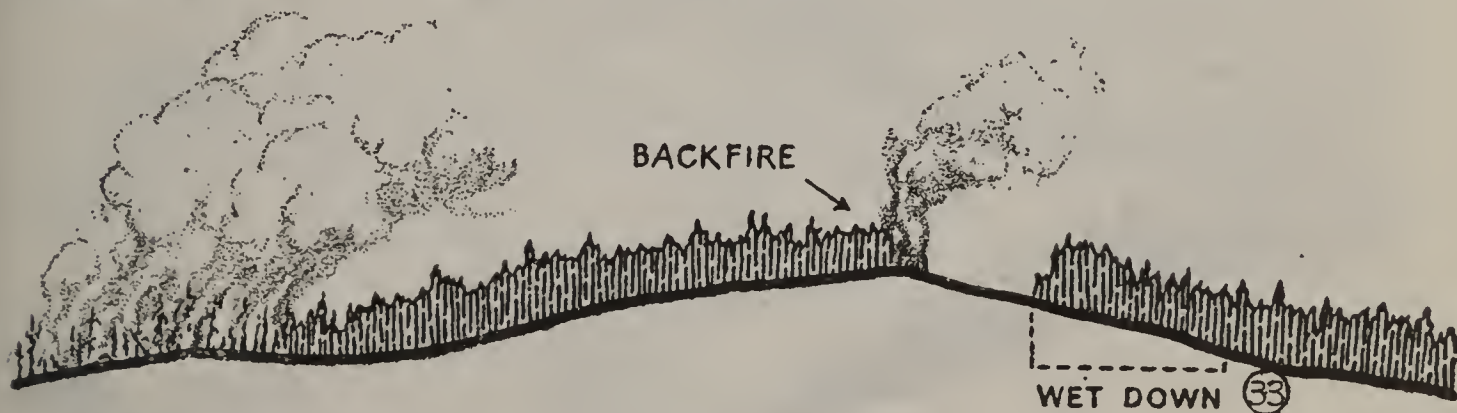
##### *Action required*

Backfire just before the pull of the draft from the main fire is evident.

##### *Why*

The fact that the onrushing fire creates a back draft in its path is extremely helpful in backfiring at close quarters. The timing of the setting of the backfire is important. The hotter the main fire, the sooner the back draft is felt.

#### Problem 5: How to use water in backfiring.



##### *Condition*

Backfiring against wind; water available; low brush cover.

##### *Action required*

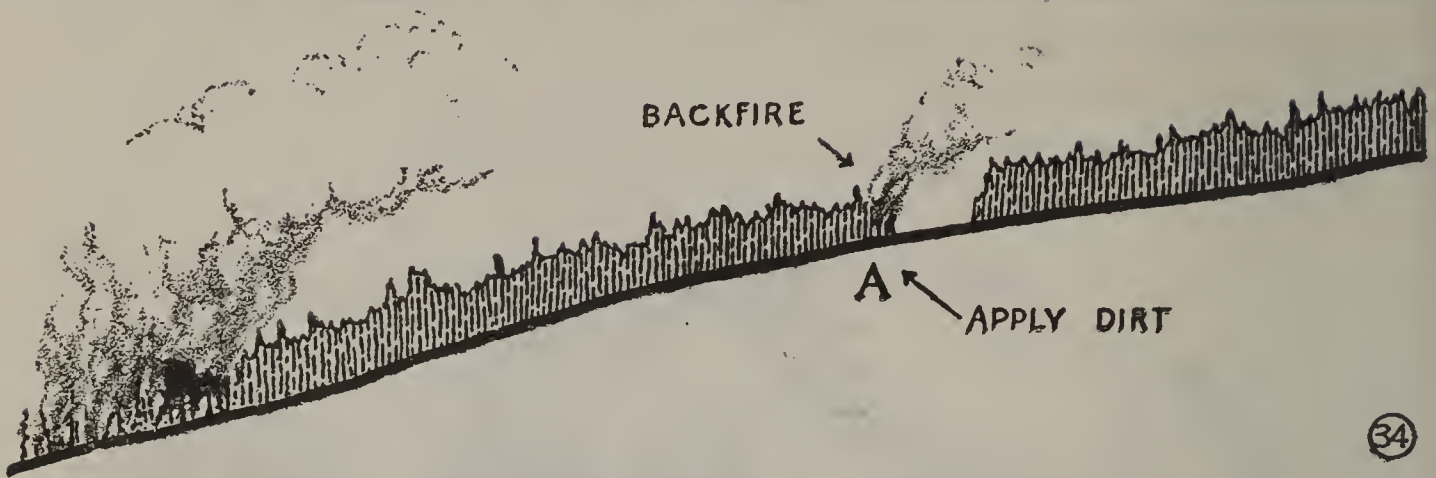
Wet down area outside of line as backfire is set.

##### *Why*

To prevent spot fires or flaring over line.



### Problem 6: How to use dirt in backfiring.



#### *Condition*

Backfiring against wind from narrow line in pine reproduction or similar cover.

#### *Action required*

Use dirt or water to decrease intensity of backfire near line until backfire burns well away from line, or until draft pulls backfire in.

#### *Why*

To reduce possibility of backfire becoming too hot, driving crew out, and fire spotting or flaring over line.

#### *Supplemental*

Same problem on any line which must be backfired before full width desirable has been built.

### Problem 7: How to backfire canyon bottom.





### *Condition*

Canyon bottom line, where no readily inflammable material exists along the lower edge of the slope.

### *Action required*

Set the backfire up the slope in good cover above the barrier. It is often advisable to go up a short distance into the inflammable material, allowing the backfire to burn down as well as upward.

### *Why*

To insure rapid and clean burn by backfire; to reduce the threat of spot fires across the canyon by allowing backfire to burn down as well as up.

**Problem 8: Emergency backfiring of a line not completed to planned terminus.**



### *Condition*

Line being constructed up a hill in advance of fire with plan of backfiring down as soon as line is completed. Onrushing fire does not give time enough to complete line.

### *Action required*

Starting backfire at top of completed section of line, and carrying it down against onrushing fire.



## Why

If successful, that portion of line already built will be saved, thus narrowing down the area of spread of the fire.

**Problem 9: How to carry backfire from top to bottom of slope under severe burning conditions.**



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## Condition

Wind up moderately steep slope, quartering to top. Rock rim at top. Fire edge farthest advanced at top; moderate rate of spread. Burning conditions favorable to backfire taking hold. Backfire line already constructed. Cover uniform. Mixed conifer type.

## Action required

Start at top of ridge and carry backfire downhill to canyon bottom, letting one stretch of backfire burn well in toward main fire before setting next section of backfire.

## Why

Main fire is farthest advanced at top and stands best chance of crossing control line near top of slope. Backfire does not have chance to gather headway and make a big front with attendant danger of sweeping over line. Backfire as gradually carried down will burn back up to already burned area with no danger of getting over top of hill or over the line.



**Problem 10: How to backfire under unusually poor burning conditions.**



*Condition*

Main fire has died down. Poor burning conditions. Wind gentle, down-slope draft. Moderately steep slope. Mixed conifer type. Impracticable to complete control by direct attack before next burning period.

*Action required*

Start backfire at lower end of line and let it spread uphill into the area to be burned out.

*Why*

To allow the backfire to gather headway due to uphill run, to develop enough heat and draft to neutralize unfavorable burning conditions and to obtain a good burn. A tricky practice, requiring careful handling.



**Problem 11: How to backfire a ridge line firebreak joining two high peaks with a deep saddle between.**



*Condition*

Heavy brush cover. Burning conditions favorable. Wind favorable. Backfiring has reached point A.

*Action required*

Continue slowly with backfiring from point A, sending part of crew to point C. Backfire from point C toward saddle, reaching saddle at B at approximately same time as backfire from A. At same time backfire slowly to the left from C or hold with a check line.

Proceed very cautiously when crossing saddle since temporary adverse wind condition may be set up by backfire.

*Why*

If the crew had proceeded from point A to point C with the backfire, the fire might escape due to uphill run from B to C.

*Supplemental*

The same method should be used to cross deep canyons or ravines with a backfire.

**GOOD PRACTICES IN BACKFIRING DEVELOPED BY PROBLEMS**

1. Properly located lines simplify the problems in backfiring. Problem 1.
2. Utilize promptly favorable weather conditions for backfiring. Problem 2.
3. Backfiring is often a highly specialized work of great difficulty, so the best special tools available should be supplied for it. Problems 3, 7.
4. In tight situations, time setting of backfire to utilize draft from main fire. Problem 4.
5. Under adverse conditions, use dirt or water as aids in holding backfire. Problems 5, 6.
6. Adapt backfiring practices to special topographic conditions. Problems 7, 11.

7. Chances must be taken frequently in backfiring under very adverse conditions. Problems 8, 10.

8. Backfiring operations should usually proceed downhill; backfires should burn uphill. Under poor burning conditions it may be necessary to start them from the lower portions of the line and proceed uphill. Problems 7, 9.

## **MOP-UP**

After control of the fire, many things commonly remain to be done before it is reduced to a patrol basis.

### **WHAT TO DO ON MOP-UP ON ALL FIRES**

1. Start work on each portion of line just as soon as possible after line construction and backfiring are completed.
2. Put all rolling fuel into such a position it cannot roll across lines.
3. Spread, rather than bury, smoldering fuel that cannot be put out.
4. Allow fuel to burn up if it will do so promptly and safely, or use water to put out as much fire as possible.
5. Eliminate promptly, both inside and outside of lines, all special threats, such as snags, rotten logs, stumps and singed brush.
6. Search for burning roots that may carry fire under control lines.
7. Fall snags both inside and outside of line if they are threats.
8. On small fires, all fire should be extinguished in the mop-up, where quantities of burning material are not so large as to make this obviously impracticable.
9. On large fires, mop up completely enough of the area adjacent to the line to be certain that no fire can blow, spot or roll over the fire line under the worst possible conditions.
10. Search for smoldering spot fires ahead of the main head of the fire.

### **PROBLEMS IN MOP-UP**

**Problem 1: How to dispose of small material burning near fire line.**

#### *Condition*

Impracticable to extinguish all fuel burning or smoldering near line.

#### *Action required*

Scatter fuel well back from line into burned area.

#### *Why*

To decrease possibility of spotting or blowing over by removing burning material adjacent to line and allowing it to burn up.



**Problem 2: How to dispose of highly hazardous fuels outside of but adjacent to fire line.**



*Condition*

Punky limbs and masses of slash just outside of hot fire line.

*Action required*

Remove fuels to a safer distance from fire line. If removal is impracticable, graves should be dug and the fuels rolled into them and covered with a layer of clean earth. This is safer than attempting to cover them by building up a layer of earth.

*Why*

To remove fuels apt to act as hosts to spot fires.

**Problem 3: How to prevent fire creeping through roots under fire line.**

*Condition*

Roots burning inside of and extending under fire line.

*Action required*

Uncover and remove burning portions of root.

## *Why*

To prevent fire burning under ground and coming up in unburned territory.

### **Problem 4: Disposal of burning snags.**

#### *Condition (a)*

Snags burning inside and near the line with fire above reach of men.

#### *Action required*

Fell snag away from line into burn, up and down hill if lean permits. To provide standing room for falling, shovel away hot material from base or cover with dirt. Scrape, cut out or extinguish with water all burning portions of the snag.

#### *Supplemental*

If lean of snag does not permit snag to be felled in burn, a space should be cleared where the snag will fall or may roll or slide.

#### *Condition (b)*

Snags burning in base only.

#### *Action required*

Knock down blaze with dirt or water ; chop or scrape out burning portion with axe or shovel ; peel off loose bark as high as can be reached ; apply dirt or water to cracks to extinguish any sparks which might be smoldering ; scatter the material removed from snag in burned-over area ; if this consists of larger material it should be buried completely or otherwise made safe.



## Problem 5: How to handle log piles burning near fire line.



(41)

### *Condition*

Logs within spotting distance of line.

### *Action required*

If logs are movable, separate and let them burn out. Move to lie up and down slope and trench end where necessary.

### *Why*

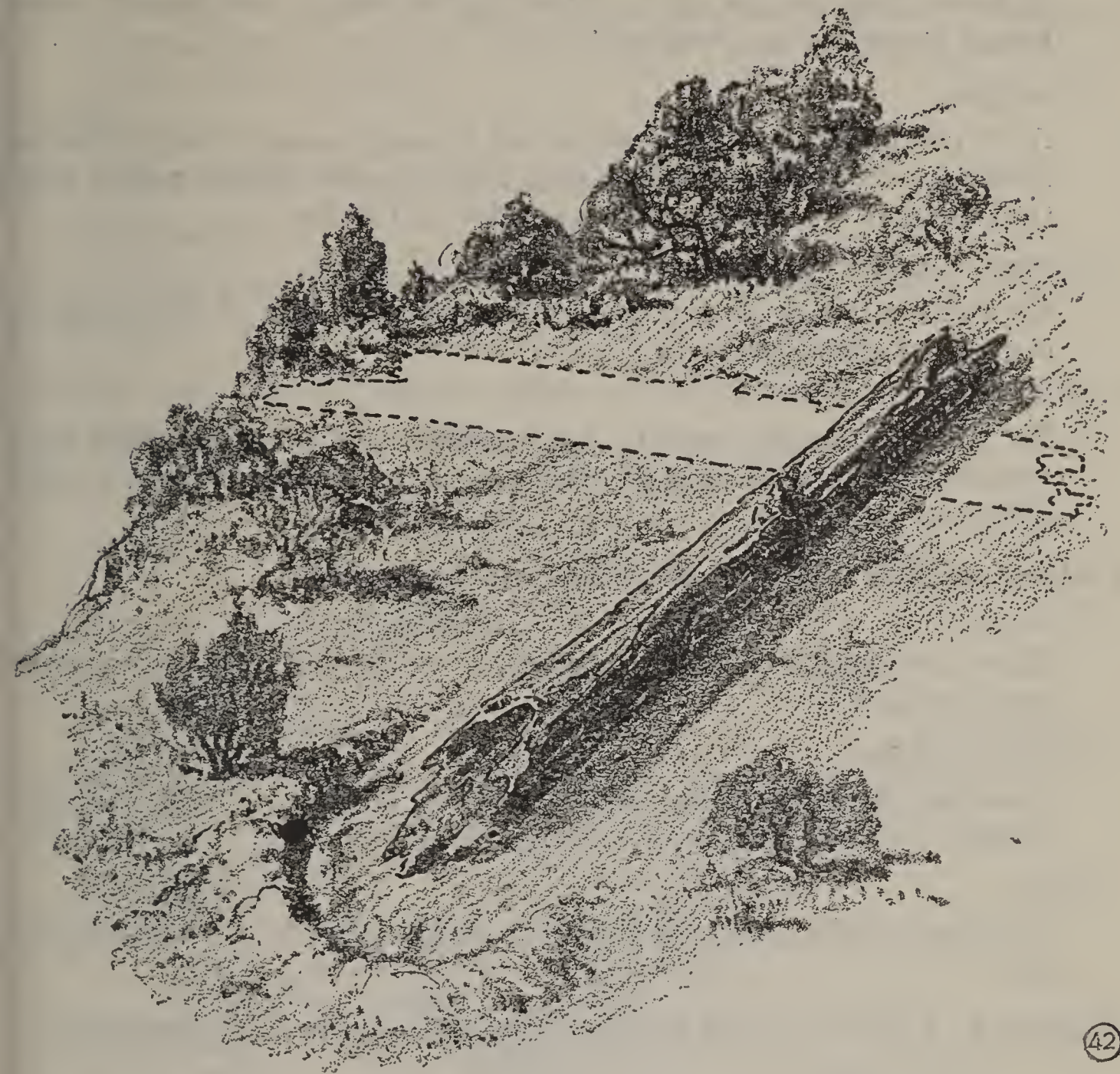
To reduce heat and thereby decrease possibility of spotting. To prevent rolling embers when steep slopes are involved.

### *Supplemental*

If logs don't endanger line or cannot roll, leave them in piles, as they will burn up faster.



**Problem 6: How to place movable, burning log so it will not roll.**



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*Condition*

Burning log lying with contour of slope.

*Action required*

Move log to lie up and down slope. Trench around lower end to catch rolling embers.

*Why*

To prevent logs and live embers rolling into unburned territory.

*Supplemental*

If a log is too large to handle, cut to sizes that can be moved and proceed as above. If log is too hot to cut, block with rock or earth and trench along lower side of log to catch rolling embers and the log itself.



### Problem 7: How to handle burning stumps.

Refer to sketches No. 42 for Mop-Up Problem 6 and No. 45 under Patrol Organization Problem 1.

#### *Condition*

A corralled fire on a steep slope has burning stumps that should be allowed to burn up but which may result in live embers rolling over the undercut fire line on the lower edge of the fire.

#### *Action required*

Construct a trench close to and on the down hill side of the stump, to catch the burning embers.

#### *Why*

To prevent burning embers from rolling and possibly going over trenched fire line. Placing the trench close to the stump makes it more effective.

### Problem 8: How to dispose of chunks and similar fuels.

#### *Condition*

Many burning chunks, etc., on moderate or steep slope; may roll over trenched line.

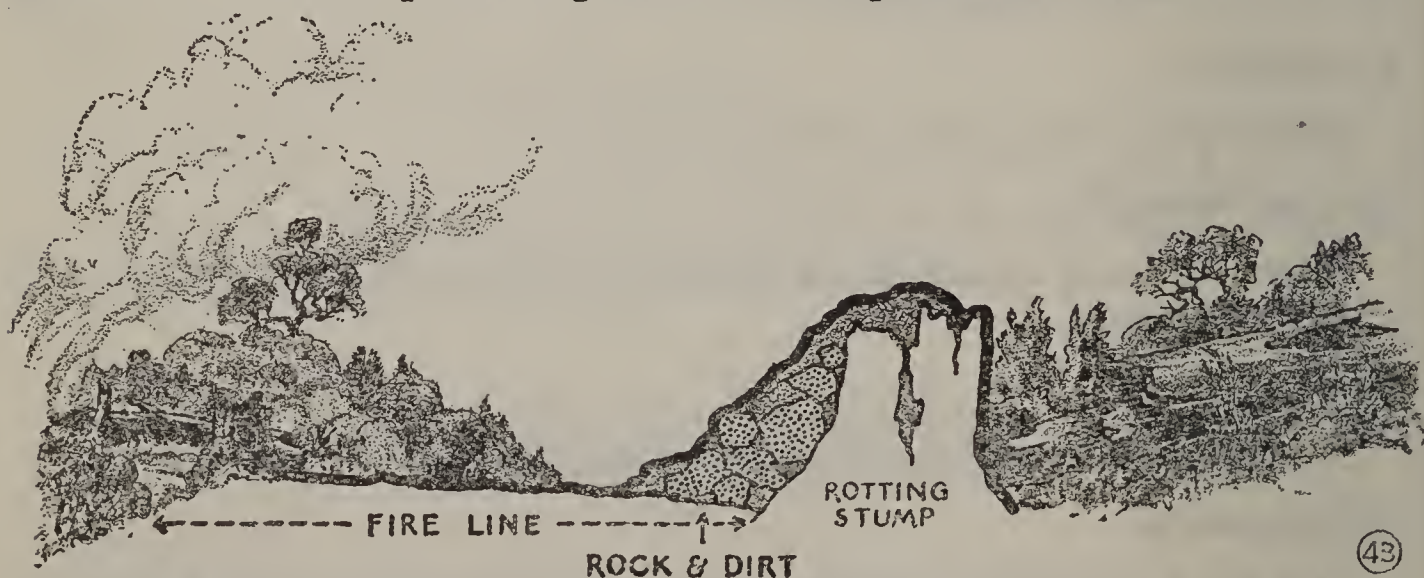
#### *Action required*

Construct trenches along slope in burn, long enough to hold the chunks. Place chunks in trenches; don't bury.

#### *Why*

To allow chunks to burn out without danger of rolling over lower fire line.

### Problem 9: How to prevent ignition of stumps outside but close to line.



#### *Condition*

A stump outside, but near the fire line, opposite heavy burning material which must be allowed to burn out.

### *Action required*

Scrape duff well from around stump. Build up a layer of earth on side of stump next to fire, using loose rocks to hold it in place if necessary. Cover top of stump with clean earth. If rocks are not available, use green chunks of wood.

### *Why*

To prevent spot fires or direct ignition of stump.

### *Supplemental*

The same method can be used in protecting a cat face on a standing tree.

## **Problem 10: How to prevent ignition of log outside but adjacent to fire line.**



### *Condition*

A dry log too large to move extending away from hot place on fire line.

### *Action required*

Cover end of log as in foregoing stump problem. Cover both sides and top of log with earth back as far as deemed necessary. Rest of log may be peeled if bark is principal hazard. A hard, smooth wood surface is much less receptive to sparks than dry bark or decayed material. Chopping out decayed spots may be effective. All debris should be



moved back a safe distance and entire log should be isolated by a fire line around it.

### *Why*

To prevent spot fires or direct ignition of log, and to isolate it with line as an additional precaution.

## **Problem 11: How to use the hands in mop-up. (Feeling for fire.)**

### *Condition*

A severe fire has burned over a small area that contained a fairly heavy stand of timber with considerable duff, a few patches of brush and some rotten logs. The fire appears to be out and no smoke can be seen.

### *Action required*

Test all of the fire with hands; feel particularly in partly consumed duff, in incompletely burned litter and into the remains of punky logs. Dig out hot spots as discovered.

### *Why*

To locate smoldering fire which cannot be seen.

## **Problem 12: How water can be used effectively in mop-up.**

### *Condition*

Fire has burned on steep slope with vertical rise from bottom to top of one thousand feet; truck trail on crest of ridge; lower fire line parallels a small stream. A tank truck, backpack water outfits and a portable pump and hose are available. Unsafe to leave fuels to burn up.

### *Action required*

Assign crew, including competent operator, to operate the pump from creek; put out burning fuel far enough back from the line so that sparks cannot blow into unburned territory, or chunks roll into it. Crew should go over the area methodically turning chunks and small logs over and over to be certain that all burning portions are put out. Pump crew should go as far up each flank line as the pumper can reach. Tanker crew should do similar work in upper fire, and work down the flanks as far as practicable.

The backpack crew men with pack cans should follow the same plan in the area not covered by the two pumpers, until the entire danger zone has been thoroughly worked. If there are very heavy accumulations of heavy fuel burning hard close to the lines they should be cooled down first with water to reduce the danger of loss of line. Occasional return visits should be made to be sure no sparks have been left in the mopped-up area.

### *Why*

Water is the most effective natural agent known for extinguishing fires. If properly and skillfully used, it will complete a job of mop-up much more rapidly than this can be done by any other means.

### *Supplemental*

In large fires it is unnecessary to work over the entire area with water. Small fires can best be drowned out completely with water, if this is available within practical delivery limits, to save patrol and to relieve the men sooner for other fire duty.

### **Problem 13: How to make safe partially burned clumps of brush or reproduction close to the lines.**

Refer to sketch No. 7 under First Attack Problem 16.

### *Condition*

A backfire ran through zone of brush close to the line but has merely dried it out without consuming the crowns.

### *Action required*

1. If the amount is not too large, cut down and scatter away from the control line inside the burn in areas free from fire.
2. Use special firing equipment, such as torches and flame throwers, to burn out scorched crowns.
3. If the patches are too large to handle by methods 1 or 2, put out all surface fire within them and construct a good line between them and the rest of the fire.

### *Why*

To eliminate the threat before the heat of the next day.

To either remove fuel or isolate from possible ignition next day. Scorched crowns of brush or reproduction are particularly dangerous fuels; they ignite readily when daytime burning conditions obtain, and fire will flash through the crowns over previously burned ground. The danger of spotting and flaring over adjacent lines is extreme.

### **GOOD PRACTICES IN MOP-UP DEVELOPED BY PROBLEMS**

1. Spread well inside of lines smoldering material that is not put out with water rather than pile it up and cover with dirt. Problem 1.
2. Eliminate or put into safe condition adjacent outside fuel of great inflammability, such as rotten logs, snags, etc. Problems 2, 9, 10.
3. Look for and dig out burning roots near control lines. Problem 3.
4. Separate masses of large fuel to reduce heat and danger of spotting. Problem 5.
5. Eliminate all snags inside of line that could under most adverse



weather conditions throw sparks over lines or fall over them. Problem 4.

6. Put all rolling material into such a position it cannot possibly roll across the line. Problems 5, 6, 8.

7. Place trenches immediately below all heavy material which might roll across line. Problems 6, 7, 8.

8. Feel with hands for possibly smoldering spots. Problem 11.

9. Use water wherever possible in mop-up. Problem 12.

10. Do not leave partially burned clumps of brush or reproduction close to fire lines. Problem 13.

## PATROL

The necessity for patrol begins when the backfire is set, or, in the case of direct attack, when the line is built. It ends when the fire is out. The needed intensity varies, decreasing as the danger decreases. As the fire burns down, and after intensive work by the organized mop-up crew, the need for intensive patrol decreases, but not the need for intensive organization. Each patrolman, whether his responsibility is a single point of danger or is a mile of line, needs to know his exact duties.

### THINGS TO DO ON ALL FIRES

1. Designate definite beats for each member of crew.
2. Designate special danger points.
3. Work on hazards as well as watch them.
4. Search systematically for fire outside of line.
5. Arrange system of communication to call for help.
6. Place lookouts for definite areas when needed to watch for flare-ups and spot fires.

### PROBLEMS IN PATROL

**Problem 1: How to handle burned-out stump hole.**

#### *Condition*

A stump near the fire line burns out as a crater but smoke and heat continue to emerge from the roots. This indicates rotten or hollow roots.

#### *Action required*

Pack the root cavities with clean mineral earth to cut off the air. This is not absolute insurance that the root fires will go out, so look carefully for evidence of root emergence across the line and dig them out if practicable. Continue to watch carefully for signs of smoke in the area within likely reach of the roots. Put a fire line around this area and reduce the hazards therein to the extent practicable.

**Problem 2: How to handle a stump burning above an undercut line.**



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*Action required*

Maintain the main trench carefully, and see that it is kept free from debris. Dig a supplemental trench immediately below the stump to catch rolling material. The closer the trench to the threatening material the more effective it is. Back slope trenches to make them more effective. Watch and check whether trench is effective.

**Problem 3: How to handle spike-topped tree within the fire line, showing signs of fire.**

*Action required*

Immediately notify patrol boss so that tree can be felled, in the meantime keeping careful watch for spot fires.

**PATROL BOSS JOB**

The patrol crew boss must be one of the most alert and tireless men on the fire. He needs to be constantly on the move, checking on the action of his patrolmen, reassigning them by definite stations as conditions change,



and maintaining touch with the mop-up or other crews constituting his source of help in emergencies. Instructions to patrolmen must be as specific as practicable, particularly as to station. If natural objects do not lend themselves to serving as markers between patrol beats, tagged stakes should be set. Patrolmen on adjacent beats should make contact at the markers at stated periods. The patrol boss must see that provision is made for distribution of food and water to his men without their leaving their stations. He should accompany the relief patrol boss over each sector of the line, giving him an up-to-the-minute picture of the situation. He should see that all spot fire locations are known to the relief patrol boss; he should place direction signs on the fire trail to each spot fire. Particular attention should be paid to areas where water has been used in suppression or mop-up to see that complete extinguishment has been accomplished.

## **FIRE SUPPRESSION ORGANIZATION**

Even though only a small crew is used on a fire, the need for organization exists. Each major step in control has characteristic features, and application of the correct organization practices is necessary to obtain quickest, surest and most economical control.

### **ONE-CREW FIRE SUPPRESSION ORGANIZATION**





## Condition

Fire is reported to foreman of a ten-man C. C. C. suppression crew at 3:00 P. M. He and crew left at once in crew truck; on arrival found fire burning briskly in an open pine stand on a moderately steep slope. It was about an acre in size. From the lookout's report, the fire was known to be a lightning strike, so no law enforcement action was needed. The men had to walk in half a mile from the road to the fire. They took tools, one full backpack pump, canteens, and an "S" type radio set.

## Action

1. Having sized up head of fire on way in, foreman found on arrival that fire had backed into a canyon and was threatening a side canyon.
2. He assigned eight men, five with McLeod tools, one with an axe, one with a shovel, one with the backpack pump, to make a direct attack on the south and lower east sides; he instructed them to prevent the fire from crossing the canyon.
3. He took one man, who had a McLeod tool, as a possible messenger, and started reconnaissance of the fire. He carried a boy's axe.
4. The head, which was over a small spur ridge, had neared a group of snags not far beyond which was a dense brush patch. He started the McLeod man to work constructing a line to mineral soil between the snags and oncoming fire, indicating where to put it.
5. Going back to the top of the spur, he called down to four of the men to come at once and help construct the line to cut off the head of the fire. He instructed three to continue working up the east side to join him, and one man to mop-up and patrol the back line.
6. He indicated definite location of the rest of the east control line to his crew.
7. He then helped the five men complete a control line around north side and for a short distance down west side.
8. This was backfired from the top as soon as built, beginning just west of the snags, and continuing around to meet the crew on the east line which by this time had come to the top of the spur and had connected the lines.
9. He had been watching all of the time for spots over the line, but since the run of the fire was not heavy and the fuel type had not created sparks, he found none.
10. As soon as the backfire had been carried down and had met the main fire, he left one McLeod tool man on mop-up and patrol from the western end of the control line to the sector of the patrolman on the east line.



11. He selected and marked a line down the west side of the fire to tie this into the previously built line in the canyon bottom.

12. He took his other men and built this line, backfiring it out as he went.

13. He left one McLeod tool man to patrol and start mop-up on the upper end of the fire.

14. The rest carried the line until fire was surrounded. He then felt sure he could hold the fire. He dropped a patrolman on this line to tie back to the upper patrolman.

15. While his construction crew, which had been hitting the ball hard, rested, he went up on the ridge where he could see Baldy Lookout, set up his radio and reported the situation to the lookout. He stated the fire was corralled and that complete control was assured in the absence of some unexpected catastrophe. He ordered food and a cook to report to the truck, which had been left at end of the road.

16. He returned to crew, sent five men to the truck to get a saw and wedges to knock down a snag that was burning well inside of the line; to bring in more water pack cans, and to bring in the emergency rations.

17. He took the other three men and started around the fire to strengthen some trench on the east side on a piece of hastily constructed undercut line; to turn around logs that might roll; to spread material that it might burn out; and to mop-up all material that might cause trouble. All lines were cleanly burned out and there were no islands or half-burned brush.

18. When the rest of the men returned, he assigned three to knock down a burning snag.

19. He took the rest and assigned specific jobs of putting out fire adjacent to the lines.

20. Since the area was small, the crew eventually worked over the entire area.

21. He kept in touch with the patrolmen to be sure they were on their toes, were making regular trips over their line sections, and were doing mop-up work on burning material needing attention.

22. He took two trips more up on the hill ahead of the direction of run to look for spot fires. He covered the entire area thoroughly but found no spots.

23. He found a spring in a side canyon, as shown on his map, and marked a trail to it from the fire line.

24. He went around entire fire, inspected all of the work, and found fine progress was being made, and that the fire was rapidly cooling down.

25. About 7:00 P. M., since all was quiet, he took his entire crew back to the truck where the cook and the supply of food he had ordered by radio had arrived. The men ate and went to bed, except for one local rancher who was hired to patrol during the night.

26. At 3:00 A. M. breakfast was started and by 4:00 A. M. mop-up work and patrol was resumed. He was a very busy man keeping close track of all the jobs that had to be done and seeing that they were handled.

27. He made one more careful search of all country near but outside of the lines for spot fires.

28. He went over the control line, foot by foot, to be sure no hollow roots ran out of the burn.

29. He inspected the tops of all trees to see that no punky places were afire.

30. He made periodic contacts by radio with Baldy Lookout during day.

31. He made a paced survey of the fire and recorded the data for a report on it to the Ranger.

32. Nothing happened all day, so at 7:00 P. M., after making a final inspection of all key points, the crew left the fire as out.

33. Record was made in a notebook of the times of the principal steps taken in suppression.

### **Summary of Correct Practices Used**

Fire was scouted.

Attack was directed to proper key points.

Lines were located and did not just grow.

Lines were backfired when built.

Lines were patrolled after completion.

Lines were mopped up promptly.

Snags were felled promptly.

Water was used extensively in mop-up.

Radio was used.

Provision made for food and water.

Spot fires were looked for.

### **DUTIES OF FOREMAN AND ORGANIZATION OF BACKFIRING CREW**

#### **Condition**

Backfire line already constructed. Size of crew: 10 men. Equipment: two backfiring torches or flame throwers, shovels and axes. Time: early evening, mid-season. Burning conditions moderately favorable; humidity



30; up-canyon draft gentle. Mature stand of mixed conifer with normal litter and some brush.

### **Action Required of Backfiring Foreman**

1. Selects tools and checks that they are in good operating condition before taking them out on line.
2. Takes water and lunches.
3. Takes extra fuel for torches.
4. Takes two torches or flame throwers, eight shovels and two axes.
5. Takes crew to highest point on line.
6. Assigns two men to firing.
7. Instructs them how to light torches or flame throwers; and how to ignite fuel.
8. Starts them firing down from top, instructing them how far to proceed before stopping for further instructions.
9. Assigns the remaining eight men to follow up backfire crew.
10. As backfiring proceeds assigns to each shovel man a marked section of the backfire line to protect against spotting or flareover.
11. Instructs them how to take care of such situations and to give the alarm if there is a break.
12. Scouts ahead of torch men along the section to be fired and examines the area along and adjacent to line for snags, logs, and dense cover which will create dangerous situations if ignited.
13. Has shovel men clear around snags, stumps, logs, etc., inside line to prevent ignition by the backfire. Often has torch men fire lines around snags before firing main line.
14. Has shovel men dirt down dangerous log ends and stumps outside of line.
15. Goes back and forth constantly along the backfired sections of line, inspecting the work and checking and instructing the shovel men. In order not to delay backfiring sees that only necessary work to hold fire is done, leaving complete mop-up until later.
16. Starts torch men to backfiring again and regulates their speed so that no more line is fired than can be adequately patrolled by shovel men.
17. Moves men forward to freshly fired sections as soon as their sections have cooled down so that only occasional patrol is necessary.
18. Leaves no section of the line unattended, to make sure no spots or flareovers have been overlooked.
19. Continues by stages until entire backfiring assignment is completed.
20. Drops off additional patrolmen as needed to safeguard line.



## Supplemental

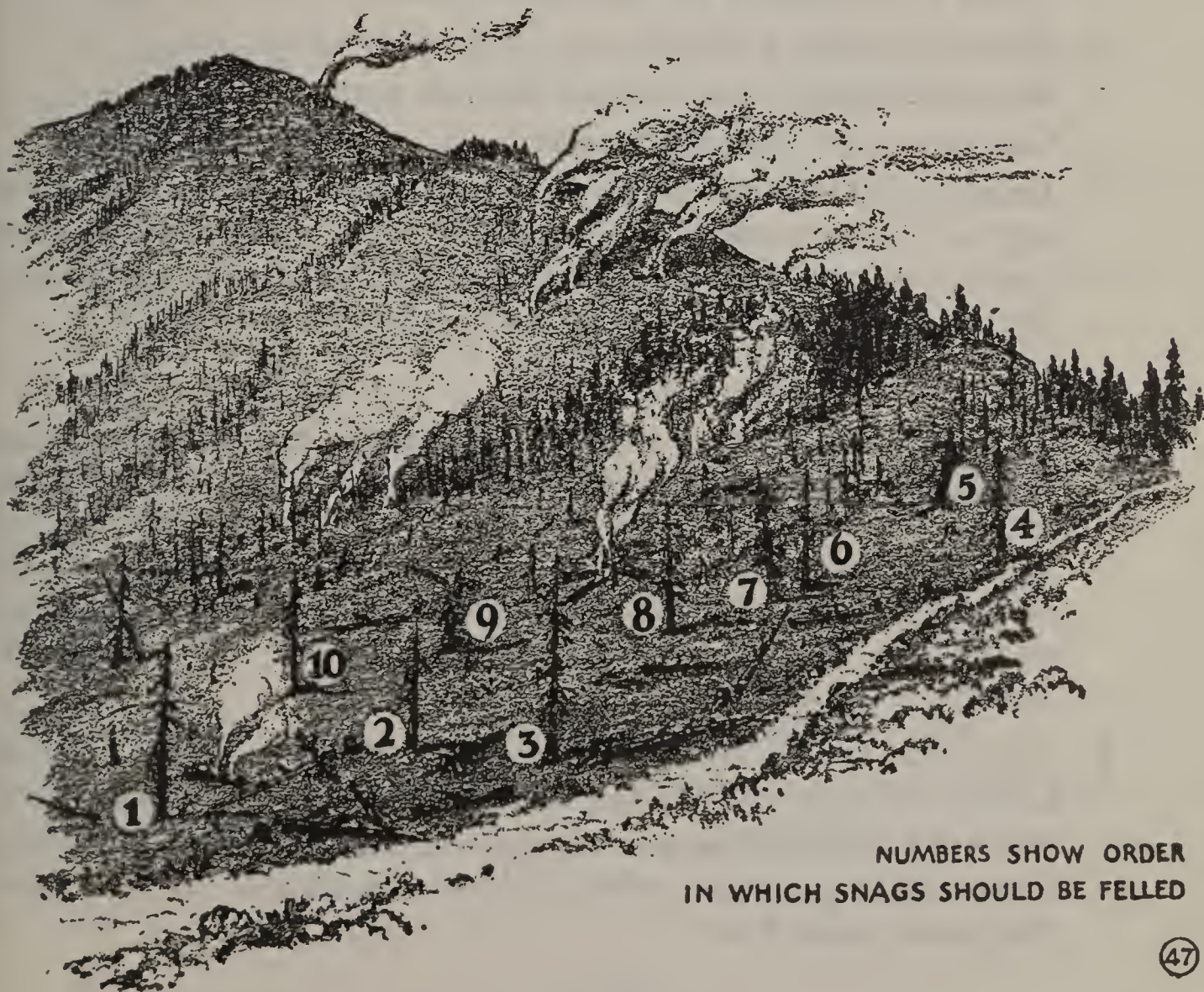
1. It is foreman's responsibility to get as complete a burn as possible. When fired stretches go out or burn in patches, he must have shovel men pile and ignite dry material to get fire started, or set a second backfire farther inside the line in readily ignited material. Use flame thrower in locations difficult to fire.

2. Time is critically important. Keep men working at top speed to complete the entire firing job before burning conditions become too poor for ready ignition and burning. In early morning backfiring, speed is essential to complete the job in time to allow the line to cool down to point of safety before the wind rises and the humidity drops, bringing dangerous burning conditions.

3. Make it a rule that men remain on their assigned sectors when eating lunches, so as to leave no sector unattended. Water should be distributed to men when initial supply is used up.

4. In situations where humidity rises so that backfiring will no longer take hold, the foreman should report progress and conditions to the fire boss. Subsequent action of the foreman will be based on the decision of the fire boss.

## DUTIES OF CREW BOSS AND ORGANIZATION OF MOP-UP CREW



NUMBERS SHOW ORDER  
IN WHICH SNAGS SHOULD BE FELLED



## Condition

Crew boss with twenty men and assistant crew boss have been assigned to mop-up one-half mile of hillside line on a large fire. There are: about ten snags to fell inside fire line, varying in size from twenty inches to forty-eight inches in diameter; many stumps to trench; several movable and a few large logs burning near the fire line; much small stuff burning along fire line; several patches of scorched manzanita along edge of fire; several burning stumps that can be put out with water; and a few stumps adjacent to outside of line opposite hot stuff inside. Time: 4:00 A. M. Required to make safe before burning period and thoroughly mopped up by evening.

## Action Required

A. Before leaving fire camp for fire line the crew boss should:

1. Fully understand his assignment as to location, best route to travel, and the exact work to be done.
2. Eliminate any men not properly clad or shod, and physically unfit.
3. Obtain needed number and kind of tools, checked as to condition, and listed.
4. Check arrangements for lunches and water.
5. Provide himself with light axe, canteen, notebook, etc.
6. Know definitely what transportation is provided.
7. Check out crew with timekeeper.
8. Issue special instructions to crew, such as safe method of carrying tools and necessity of individuals staying with their own crew.
9. Check men and equipment onto truck, or line them up between himself and the assistant crew boss if travel is by foot.

B. Action when he arrives at fire:

1. Organizes nine men for working as a unit on hot stuff. Each man is equipped with shovel; also three axes and two backpacks in crew. Places assistant crew boss in charge, and instructs him to work his crew as a unit along the fire edge both inside and outside, taking care of the most dangerous material next to the line on the first trip through. On the return trip they will thoroughly mop-up to the desired distance from fire edge.
2. Organizes falling crew of three men with one of the men as leader, equipped with felling tools and one shovel. One man will watch for falling limbs and chunks while the other two fall snags. Shovel to be used for cooling down snags. Starts crew on most dangerous snags first.

3. Selects two shovel men to trench stumps and instructs them to take care of most dangerous stumps first, then to work other stumps. Instructs them to cut off burning roots extending toward line.
4. Selects three men, including a leader, to move logs to prevent rolling, to trench and block large logs, and to move log piles. Equips each with shovel and puts two axes in crew unit.
5. Takes remaining three men, each equipped with axe and shovel and with one backpack for the crew, and places them at dangerous points along line not yet reached by mop-up crew. Establishes definite patrol sections for each man. Instructs men to check constantly along the edge of the fire both inside and outside, and to do emergency mop-up work at most dangerous points to hold fire in check until arrival of the main force.
6. After crew boss has established organization on the ground, he constantly works between units to supervise and inspect their work and makes such changes in the plans as the exigencies of the situation demand.
7. When any unit completes its assignment, he reassigns men to other duties.

### **Summary of Duties**

To identify specific dangers and to see that they are eliminated is the continuing job of the foreman. These duties usually include:

1. Carrying mop-up far enough from fire edge.
2. Preventing possible roll across line of material, such as logs, chunks, and yucca plants.
3. Hastening burning out of duff, etc.
4. Extinguishing with water.
5. Removing scorched brush or reproduction from fire edge.
6. Covering up punky logs and stumps outside line.
7. Disposal of snags.
8. Watching for spots, burning snags, etc., outside line.
9. Feeling for hot stuff before assuming that any given part of fire is out.
10. Cutting off burning roots that extend toward line.

## **ABANDONING FIRE**

### **Things to be Checked by Fire Boss Before Abandoning Fire**

A. *Inside the fire.* Within threatening distance of line, check that—

1. All snags and spike tops have been felled.
2. Logs and chunks either
  - a. Burned up;



- b. Fire completely out and surrounded by safe line;
  - c. Lying up and down slope; or
  - d. Trenched immediately below if on steep ground.
- 3. All stumps
  - a. Burned up; or
  - b. Fire completely out.
- 4. All unburned patches
  - a. Surrounded by safe line; or
  - b. Burned out; or
  - c. Cut down and scattered.
- 5. All brush and reproduction with scorched dry crown
  - a. Cut down; or
  - b. Burned out with torch.
- 6. All smouldering litter, duff, rotten wood, etc., scattered and burned up.
- 7. All craters left by burned-out stumps filled with dirt and tamped down.

B. *The fire line.* Check that—

- 1. Continuous, clean line is built to mineral soil:
  - a. No roots at or near surface;
  - b. No stringers of rotten wood;
  - c. No stringers of needles or leaves kicked across line.
- 2. No burning or smouldering material left along fire edge.
- 3. No unburned patches against line.
- 4. Trench constructed on undercut lines on steep slopes.

C. *Outside fire line.* Check that—

- 1. Ground has been covered systematically in zone surrounding fire, with particular attention given to:
  - a. Smouldering spot fires on rotten logs, stumps, and base of snags;
  - b. Smouldering spots in piles of old bark;
  - c. Smouldering spots high up in snags and spike tops;
  - d. Smouldering limbs and knot holes in oaks;
  - e. Material that might have rolled across lines during control.
- 2. Zone near line has been checked for surface roots which may come from stumps burned just inside fire.
- 3. Spot fires have been completely extinguished.
- 4. Lava cracks or rock fissures have been followed up and checked.

### **BACK-OF-THE-LINE SUPPRESSION JOBS**

The foreman on the line needs to know what he can count on from look-out and dispatcher; what they do and how they do it; and what information they expect from him.

The specialized character of these jobs dictates definite procedures and practices. These are set forth below:

## **THE LOOKOUT'S DUTIES**

### **In Detecting Fires**

1. Regular hours of duty, and special night observation after lightning storms.
2. Systematic covering of entire visible area not less than four times per hour, with more frequent attention to high danger areas.
3. Particular attention to vicinity of industrial smokes.
4. Recording lightning strikes—watching carefully for possible fires.
5. Special service as required by dispatcher.

### **In Reporting New Fires**

1. Prompt and accurate report to dispatcher by protractor readings and approximate location on first appearance of suspicious smoke. If necessary, continue to check, reporting final determination whether or not there is a fire as soon as possible.
2. Accurate description of apparent size, color of smoke, kind of material in which fire is burning, slope aspect, situation in relation to gulches, ridges, roads, etc., and similar information on area into which fire is headed.
3. Report cause of fire when clearly evident.

### **In Reporting to Dispatcher on Going Fires**

1. Prompt report when evident that suppression forces have arrived and work begun.
2. Report when control evidently assured.
3. Report if fire gets away—where, type, character of country, etc., into which headed.
4. Report when fires which suppression forces should have reached show no evidence of being worked.

### **In Suppressing Fires**

1. If definite territory assigned, as for lookout fireman, going to fire on dispatch. Then becomes a fireman subject to instructions for that position.
2. Lookout man subject to dispatch to fire at any time whether position classified as lookout-fireman or not.

### **Responsibility for Records and Reports**

1. Written log by hour and minute of all calls made and calls received.
2. Written record of azimuth, location and vertical angles is required of



all fires reported.

3. Written record of humidity, wind velocity, wind direction, temperature, and lightning storm observations as required in local instructions.
4. Written or map record of lightning strikes by azimuth and location.
5. Map record of false smokes and legitimate smokes.
6. Special report on visibility of fixed targets as specified in local plan.

## THE DISPATCHER'S DUTIES ON GOING FIRES

### Things to Do on All Fires

1. He receives and records the reports on all fires.
2. If there can be no question as to location, he dispatches the most available fireman or crew foreman, giving him the location, route, character and size of fire, size of force to take, etc.
3. If there is doubt of exact location, he checks with other lookouts, using visible area map, and confirms location of fire, plotting on string map. The actual departure order of the fireman is withheld until this check is made and he is given exact information.
4. From conditions described by the lookouts and from his own knowledge of the country, supplemented by studying panoramic photographs, he decides upon the necessity for follow-up and follows through as determined by calling and ordering the departure of additional guards, suppression crews, work crews, or outside organized crews, from sources listed in the Forest Fire Plan.
5. He notifies his superior officer of location of fire and action taken.
6. He calls for reports by the lookouts at short intervals concerning the progress of the fire.
7. He keeps currently a log record of calls received and made, and action taken.
8. He covers up holes left by guards and crews sent to the fire as required by the Forest Fire Plan, and provides emergency detection if smoke conditions require it.
9. He provides that food, water if necessary, special tools, and communication equipment, as likely to be needed, are dispatched to the fire.
10. He obtains and transmits fire weather information to the fire boss.
11. He checks upon the availability of additional crews, equipment and food supplies, often making provision for standby service if the men and materials are not immediately needed.
12. The dispatcher, on his own initiative, provides continuous follow-up, as stated in each Forest Fire Plan. As a general service policy, he

must, in the absence of a superior officer, have authority to follow his own judgment until he receives word from the firemen, District Ranger, or other fire boss in charge of the fire. When such contact is once established, his actions will be ruled by the instructions of the fire boss, but the details of providing additional follow-up as ordered will usually be his responsibility. He should anticipate needs and make advance preparations to the greatest extent possible.

### **Supplemental Duties During a Going Fire**

1. Keep Supervisor's office (and District Ranger if he is not already on the fire) advised of changes in situation.
2. Keep up-to-date information, including rough map, number of men, etc.
3. Keep other Ranger Districts, Forests, or co-operating agencies advised, particularly if additional help is likely to be needed, or if such units have already been called upon to assist.
4. Anticipate and arrange for relief overhead and crews and for himself.
5. Watch warehouse stocks and initiate action if replacements are needed.
6. Notify co-operating units or agencies of the time of return of their men and equipment.
7. After the fire, obtain and check fire records and data.

In general, the foregoing responsibilities apply to action on an individual fire whether the dispatcher operates for a Forest or for a Ranger District. Where initial action is taken by a district dispatcher, who then goes to the fire, the problem is complicated somewhat but the job is not materially different than when one man stays with the job. Whoever takes over the job must be in a position to follow through.

### **PROBLEMS IN DISPATCHING**

#### **Problem 1: Dispatching action when one fire is reported in incendiary country.**

##### *Condition*

Fire season in full swing with normal fire weather. No recent lightning storms. Area is one in which incendiary fires are quite common. Lookout can see one fire on a ridge not far from a trail leading down into a deep canyon.

##### *Action required*

Dispatcher sends in much stronger crew than is needed to suppress single fire with instructions to man in charge to comb promptly on



arrival the adjacent country with part of the crew, after being on the watch going in to see if any more fires have sprung up. Instructions are to call back on radio as soon as fire is reached to report conditions and to get location of any additional fires reported by the lookouts.

### *Why*

A single incendiary set in this country is unusual. It is good business to anticipate that more than one fire has been set and to organize the suppression attack to control several sets promptly with a minimum of area burned.

## **Problem 2: Dispatching action when there is great uncertainty as to size of fire.**

### *Condition*

Fire is reported by lookout in an area not directly visible to him so he can give no accurate estimate of exact size. Mid-season with normal fire weather. Dispatcher has no means to get an immediate check from any other point because no one is so located that he can look into area without considerable travel time.

### *Action required*

Dispatcher sends in a strong enough force to control a moderately sized fire in the general type of country in which he knows this one is burning. He also gives instructions to the man in charge to send out a report by radio, or by messenger to a designated telephone instrument, so if more help is needed this can be sent in without any delay. He arranges for an airplane flight to be made within the next three hours to check on the situation.

### *Why*

The dispatcher feels his information is so meager he must play safe and provide an adequate crew to meet the average worst situation that might be encountered. The travel time into the fire is quite long so advance action is necessary. He takes the added precaution of the check from the air to satisfy himself of the conditions.

## **Problem 3: Dispatcher practice when uncertain on which side of impassable barrier fire is located.**

### *Condition*

Lookout man reports smoke rising over ridge with base of fire not visible. States fire in canyon but uncertain on which side of river it is located. River too deep to ford—no bridges, boats, or overhead cableway in vicinity.

### *Action required*

Dispatch two suppression units—one along each side of river.

### *Why*

To assure that one unit will reach the fire. If only one unit was dispatched, it may find that it is on wrong side of the river with no possibility of crossing, with result that initial attack is long delayed.

### **Problem 4: Dispatching action when the weather bureau forecasts a severe lightning storm.**

#### *Condition*

No man-power is located in the vicinity of the area where the fires are predicted to occur. Country is dry, and even though light rain is forecast with the electrical storm, there is great possibility of fires starting, spreading and getting beyond control unless attacked promptly.

#### *Action required*

Man local emergency lookout points.

Dispatch in advance an organized crew equipped with supplies, tools, and radio to the area. Instruct the crew foreman to establish communication and stand by for developments.

If no radio is available, dispatch men to point closest to the area having telephone communication, establish communication and stand by for developments.

### *Why*

To assure prompt detection and accurate location.

To have man-power available in the area where the fires may start to assure prompt control.

### **Problem 5: Dispatching practice when reported location of fire may be in other agencies' protection zone.**

#### *Condition*

Fire in foothills ; bad fire weather.

#### *Action required*

Dispatch initial attack at once; then notify dispatcher of other agency.

### *Why*

To obtain quickest possible action ; leave question of whose fire for later determination.

#### *Supplemental*

When reported location is outside of National Forest but near boundary, and Forest Service forces can reach it quicker than those of other agency, the same action is taken.



**Problem 6: Dispatching action when conflicting discovery reports from several sources leaves question whether there is more than one fire.**

*Condition*

Area has never had incendiary fires. During period with no lightning storms, one lookout reports fire by azimuth and topographic location; another reports fire similarly in same general vicinity; two reports do not match up.

*Action required*

Believe both lookouts, and dispatch to both fires.

*Why*

To play safe and avoid delayed attack on one of the fires. It is easy to assume, in country where fires have always occurred singly, that one lookout is mistaken.

**Problem 7: Dispatching practice when a fire, to which a crew has been sent, continues to show up or increase in size after crew has had time to reach and work on fire.**

*Condition*

Report from lookout indicates fire is an "A". Moderate rate of spread territory. Topography flat. One crew only of six men has been sent in truck, travel time twenty minutes. No word back from crew. Forty minutes later lookout reports no apparent progress in suppression action. Does not look especially dangerous yet.

*Action required*

Dispatch another crew immediately.

*Why*

To be sure fire is manned; first crew may be lost or truck broken down. From his knowledge of conditions, the dispatcher feels that the original crew should cause smoke to decrease in twenty minutes of work. Failure of smoke to decrease tells the dispatcher that either (1) the crew has not arrived at the fire, or (2) that some unknown conditions have resulted in failure to control the fire. Either of the above calls for more men to the fire.

**Problem 8: Dispatching practice when the lookout has reported several lightning strikes in a given locality but has reported only one smoke.**

*Condition*

Moderate amount of rain with storm. Part of lightning strikes in blind area behind ridge from lookout.

*Action required*

Dispatch crew to reported fire. Instruct crew to corral the fire and

then search systematically a specified area, where lookout says lightning struck, for additional fires and put them out.

### *Why*

To be sure all fires occurring are manned promptly. To have crew put out all fires while in locality. Fires not smoking up much and not visible to lookout might go unmanned and break out later when conditions would make them much harder to extinguish.

## **Problem 9: Dispatching action on concentration of lightning fires.**

### *Condition*

Unexpectedly severe lightning storm with very scattered precipitation, scattered fires in considerable numbers throughout Ranger District. Dispatcher has unit maps with protractors on them prepared in advance to use as work sheets as well as forms on which to record in detail data supplied by lookouts.

### *Action required*

1. Tie down available men, crew leaders, permittees, cooperators, pack and saddle stock, and motor transportation, at points that can be reached directly by telephone.
2. Concentrate tools, equipment and emergency food supplies at above points of labor concentration.
3. Get qualified assistance to record lookout readings, and to help plot and determine locations of fires.
4. Hold up dispatch of forces until full picture of fire load in a given area is available from all initial reports from all lookouts and co-operators, including a record of number of lightning strikes by natural units from lookouts. (See Lightning Strike Record, Appendix 15.) This does not preclude immediate dispatch to known fires in areas which had no rain and are rapid spread type.
5. List fires having accurately determined locations, eliminating all readings relating thereto from the later problems of locating fires not now certain. Such definite locations are arrived at by matching on the work map the readings from the different lookouts which give not only the azimuths but as many of the following points as possible on *each* reading:
  - a. Is fire viewed directly, or over an intervening ridge? (Use visible area map to check lookout.)
  - b. Where is it located by direction and distance from specific topographic features?
  - c. Apparent size in general terms.
  - d. Is it in single snag, on ground, in brush, or where?
  - e. Color of smoke or other distinctive features.



- f. Estimated distance from lookout.
  - g. Vertical angle.
6. Assign identified fires to nearest available crews having each leader write down location, route of travel, etc., of all fires assigned to him, with instructions to report back condition of each fire as soon as practicable either by radio or by messenger to the nearest designated telephone. Where more than one fire is assigned to a crew, specify the order of attack. Ordinarily crews will take at least twenty-four-hours' food with them to eliminate need of immediate follow-up.
  7. If there is a decided chance, as indicated by the record of strikes or unmatched cross shots, that other fires exist in the territory into which crews are being sent, the dispatcher will send larger crews (including messengers) than are needed to suppress the known fires, with instructions that a certain specified area be scouted after the known fires are corralled; and that all fires found be controlled or checked if at all possible. Any message sent out should report where other fires are encountered or seen on the way in, which are to be handled, so the dispatcher will know what is being done.
  8. Record the time of departure from a specified point of each crew dispatched. Estimate and record how long it should take each to arrive on the fire or fires assigned to it. Report this to the lookout who can best see the fires and require a condition report from him within half an hour after the estimated time of attack on each fire. Use hour control maps in this.
  9. Have each lookout recheck all of his previous fire readings that have not yet been tied into specific fires with the dispatcher:
    - a. Can he still see a fire at each point?
    - b. Has it changed and has it now any special characteristics?
    - c. Is it in a snag, on the ground, or in brush?
    - d. How large is it?
    - e. Has it crowned?
  10. Try to match up as many of the readings as possible from the new descriptions; and where fires are identified, take steps to man them, working on those first that are most likely to cause difficulties.
  11. Make the most logical matching of readings and have the lookouts and any cooperators who can see into the country look at the points where the intersections show fires to be, to see if they exist. As they are identified, proceed to man them. Continue this process until all fires are given attention.
  12. If reports come in from lookouts, in accordance with paragraph 8 above, showing that suppression action on fires to which crews

have been sent is not taking effect and fires are spreading, follow-up action should be taken to supplement the initial attack.

13. Should reserve man-power, tools and equipment anywhere along the line be approaching too low a point to be safe, assistance should be requested from other parts of the Forest so that it will be available when needed.
14. As soon as it can be used to advantage, airplane service should be asked for in order to keep in touch with the fire suppression action and to look for other possible fires.

### *Why*

To set up an advance organization adequate to handle a large volume of emergency work. It is dangerous to start prematurely before the size of the entire job is appraised.

To make strong enough forces available to handle the probable load.

To use all available facilities, including lookout checks, for identifying fires.

To require scouting for fires not yet available to lookouts in areas where lightning has been striking.

To record all action systematically.

To make follow-up of initial action automatic on lookout report without waiting on word from fires.

To ask for help before the breaking point is reached.

To use radio and airplanes to supplement the regular facilities and to be sure nothing is left to chance that can be guarded against.

## **Problem 10: Dispatching practice when fire is in flat, featureless country.**

### *Condition*

Small lightning fire, definitely located on map, but no distinctive feature to tie to on ground.

### *Action required*

Determine nearest point on road with identifying feature; calculate with protractor on map the compass course from road point to fire; instruct guard and have him write down (a) specific point of departure, (b) compass course to run, (c) approximate distance to fire.

### *Why*

To insure prompt and certain finding of fire; to reduce wandering around and lost time.

## **GOOD PRACTICES IN DISPATCHING DEVELOPED BY PROBLEMS**

1. Hold up prompt dispatch of suppression forces only when immediate additional check may add to information already available. Problem 9.



2. Play safe by sending more men.
  - a. If doubt as to size of fire. Problem 2.
  - b. May be more fires in same area. Problems 1, 6, 8.
3. Play safe by sending two crews if barriers may prevent one from reaching fire. Problem 3.
4. Dispatch in advance when lightning storm predicted. Problem 4.
5. Don't wait for exact information as to area of responsibility when location may be in either National Forest or other protection agencies' zones. Problem 5.
6. Calculate and give detailed instructions for dead reckoning compass course to small fires in flat country. Problem 10.
7. Dispatch second crew if there is doubt that first crew has reached fire or is controlling it. Problem 7.
8. Use all facilities and checks for identification of each fire in lightning concentrations. Problem 9.

## **GUARD DUTIES OTHER THAN DIRECT SUPPRESSION**

Besides direct action in suppressing fires other duties are an inescapable part of the guard's job.

### **Care of Equipment on Fires**

1. Make available in camp and on the line the kinds and quantities of equipment most suitable for all of the jobs to be done. Keep record of equipment issued and returned.
2. See that tools are in usable shape to start with, and are kept so.
3. Provide facilities for equipment upkeep and a stock of replacement parts for easily expended articles.
4. See that the men know how to use safely and properly the tools or equipment supplied.
5. Provide a simplified system of property responsibility so as to minimize losses.
6. Check property before leaving fire so search can be made for any that is missing.
7. Report losses to his official superior on return to station, and obtain prompt replacement.
8. Recondition all tools immediately on return to station.

### **Timekeeping on Fires**

1. Keep complete and accurate daily or hourly time records of the actual time worked by all men used on the fire.
2. Sign each slip for hired labor after signature by the man himself, before release, to insure against later disputes.
3. Enter on the time slips all commissary items issued.

4. Keep time of all hired pack stock and turn in on the approved forms to the Ranger.
5. Transmit promptly all such records to his official superior as soon after the fire is over as is practicable.

### **Other Records on Fires**

1. Keep written record as to the exact time each action in the suppression job takes place.
2. Prepare and send in Compensation for Injury reports on Forms CA-1 and CA-2.
3. Supply promptly to the Ranger complete and properly acknowledged records of any bills for supplies or services contracted for locally on the fire by the man in charge.
4. Keep speedometer and mileage or hours of use records on all cars or trucks hired on the mileage basis; submit as the basis of settlement.
5. Report to Ranger on the size of the fire as determined by a field survey.
6. Make estimate of amount of damage by fire; it is needed by the Ranger for his damage appraisal record.
7. Report whether start of fire was in area visible to a lookout, as a check on the lookout service.
8. Make out fireman's report before leaving fire.

### **Care of Crew on Fires**

1. See that the men are fed as well and regularly as possible.
2. Provide supply of water on the lines.
3. Keep the men equipped with proper shoes and clothes.
4. Provide rest periods for men even though these periods are short.
5. Decide in advance and advise crews on lines of retreat in dangerous places.
6. Keep lookout for falling limbs when timber falling crews are working.
7. Send no men into places he would not go himself.
8. Agree in advance how crews will scatter when warning cry of "Timber" is given.
9. Instruct men to be ever watchful of burning snags.
10. Instruct men to look out for rolling rocks on steep slopes.
11. Instruct men to carry and handle cutting tools with due consideration for themselves and adjacent workers.
12. Take care of cuts, burns, blisters, bites, or other minor injuries promptly.

### **Progress Reports on Fire**

1. Keep dispatcher advised currently of status of fire suppression by



radio if advisable, or by messenger and telephone where this is best method.

2. Report in promptly to dispatcher when leaving fire, either by radio or by telephone at first opportunity.

### **Personal Equipment to be Carried to Fires**

1. R-5 Guard Handbook.
2. Forest Fire Plan and individual instructions.
3. Forest Service key.
4. Tools, supplies and equipment, as required in the Forest Plan.
5. Law Enforcement Manual.
6. A watch.

## **COLLECTION OF EVIDENCE FOR LAW ENFORCEMENT**

### **Advance Action**

In incendiary areas, remember always that the noting and recording of any facts that may bear on the actions of fire-setting suspects are of great importance. Get the habit of jotting down places and times of meeting such persons, since these may be important later in reconstructing the history of fires.

In other classes of cases, the background may not be quite so important, but a record of the number of a license plate on a certain car may prove just the clue needed to link an offender with his action. The important thing to remember is to observe and record anything usable later as evidence.

### **What to Do on a Fire**

1. As the guard goes in he will watch for people coming out of general area, and for tracks.
2. When he arrives he will determine where the fire started and the probable cause.
3. He will carefully, but speedily, examine for clues the immediate area around the starting point. He will be careful not to destroy any tracks or marks in the search. He will keep his crew from destroying any evidence.
4. If found, he will preserve by covering up with brush or limbs any tracks or marks (foot, horse, or automobile), including distinct sections of automobile tracks.
5. He will pick up by the edges or corners, preferably with clean gloves or hands protected by a clean handkerchief, any movable evidence found. He will put this away in a safe place for future use. He will not use bare hands, or finger prints may be destroyed. The most common clues are: lunch remains; scraps of paper or cloth;

supply boxes; cigarette butts; unusual cans or bottles; remains of incendiary plants; patches of horse or mule hair.

6. After making written record, he will pass on to the investigator all the material secured, with full explanation where it was secured; and will show him any ground evidence, after recording similar data in the notebook.

## **Importance of the Job**

The job of determining the cause of each fire first reached by the guard, and of collecting all available evidence tending to prove who started such fire, if of human origin, is of importance second only to the actual putting out of the fire.

The thoroughness with which the job is done and the way in which the evidence is collected, handled, safeguarded, and passed on to the final investigator will determine the success or failure of the law enforcement case.

The guard has the only real chance there is to obtain the evidence and must act with this point always in mind.

In order to know when violations have occurred, the guard must know the various Federal fire laws and regulations, the State fire laws, and the County fire ordinances which he is expected to enforce. All of these are summarized in the Appendix, except the County ordinances, which are given in the Forest Fire Plans.

## **Legal Powers**

### *Federal laws and regulations*

ARREST—The guard has the authority under Acts of Congress to arrest upon warrant any person charged in a proper complaint with violating Federal laws or regulations relative to National Forests.

### *State laws*

ARREST—Only guards who have been appointed as State Fire Wardens can arrest under warrants persons who violate State laws.

### *County ordinances*

ARREST—Guards have only such authority as is given to them because of their Federal employment in the ordinances themselves.

### *For all offenses committed in their presence*

ARREST—Forest Officers can arrest without warrant persons committing crimes or misdemeanors in their presence, under either State or Federal laws.

## **General Principles of Action**

1. Guards will not ordinarily accept local deputization as peace officers.
2. Guards will serve warrants only when proper Federal or local police officers are not available.



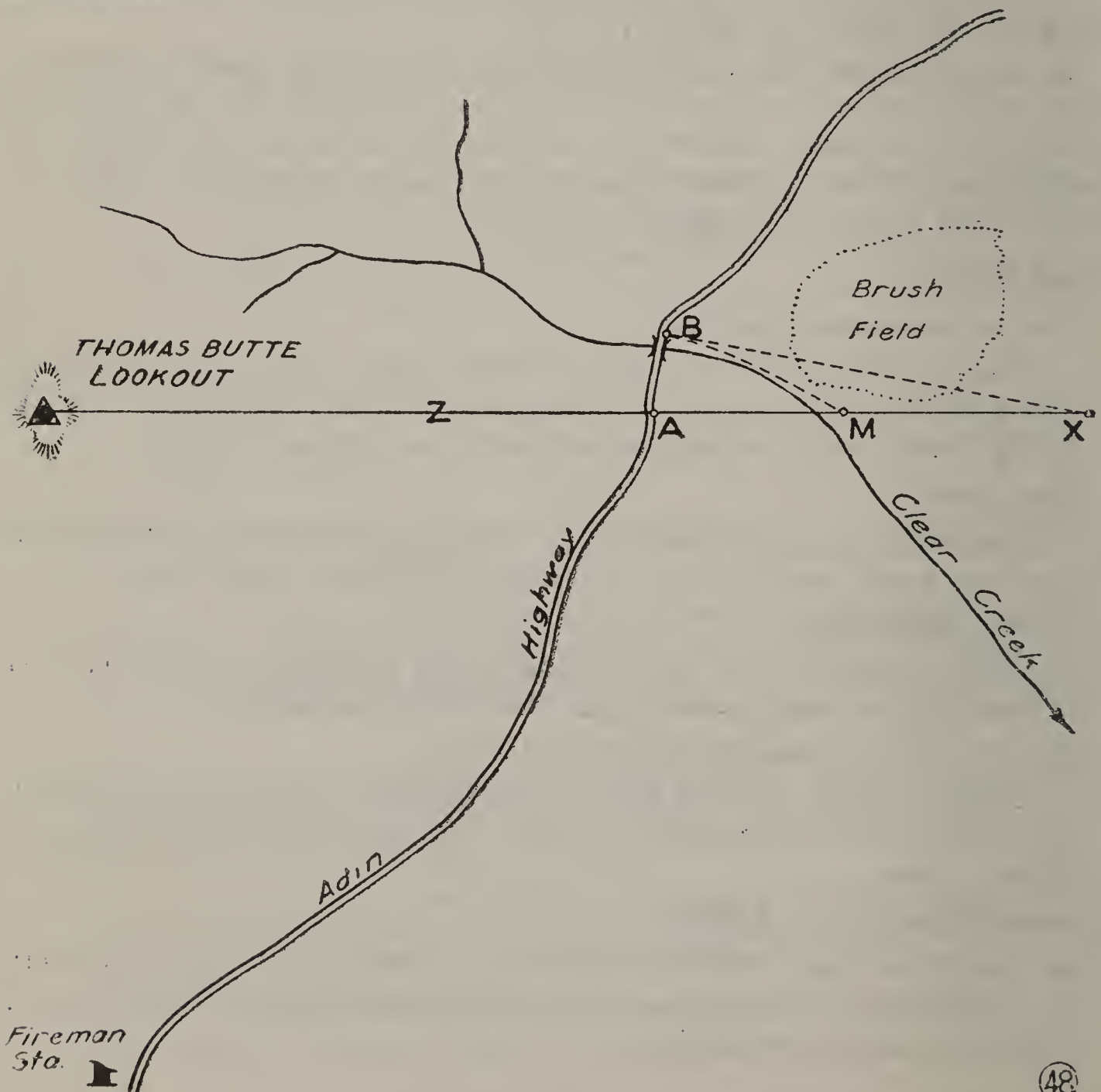
3. Guards will arrest and take in persons only when caught in the act of committing flagrant violations which if continued will seriously threaten the safety of the Forest; for example, a crazy man spreading fire in the woods.
4. Guards will serve citations for violations of minor County fire ordinances when this procedure is approved in writing by the Supervisor in the Forest Plan.
5. When in case of doubt consult the Ranger, as serious personal consequences can arise for improper action, such as that of false arrest.

### SPECIAL METHODS USED BY GUARDS

The following problems illustrate situations met by guards in finding, sizing up, locating and reporting on fires:

#### USE OF MAP AND COMPASS IN LOCATING FIRES

##### Problem 1:



### *Condition*

Fire located at X by Thomas Butte lookout, with cross shot from another lookout. Generally flat country. Little smoke showing and probably will be hard to find. Fireman equipped with map and compass.

### *Action required*

Fireman receives from dispatcher and carries out following instructions:

1. Spots fire on map, draws line on his map from lookout to fire and records azimuth from Thomas Butte and other instructions as given by dispatcher.
2. Proceeds in his car to Clear Creek bridge, thence paces back 20 chains to point A on road (calculated by dispatcher).
3. Proceeds on line of sight as determined by use of compass and known azimuth, pacing 125 chains to the fire.

### *Supplemental*

If fire were located at Z, the fireman would determine the direction from A to the fire by using the back azimuth instead of the azimuth.

## **Problem 2:**

### *Condition*

Same situation as in Problem 1, except Clear Creek is impassable except on bridge.

### *Action required*

1. Fireman receives instructions from dispatcher and records same in notebook and on map.
2. Proceeds to bridge as in Problem 1.
3. Paces to fire on line B-X, using azimuth and distance (128 chains) as provided by dispatcher.

## **Problem 3:**

### *Condition*

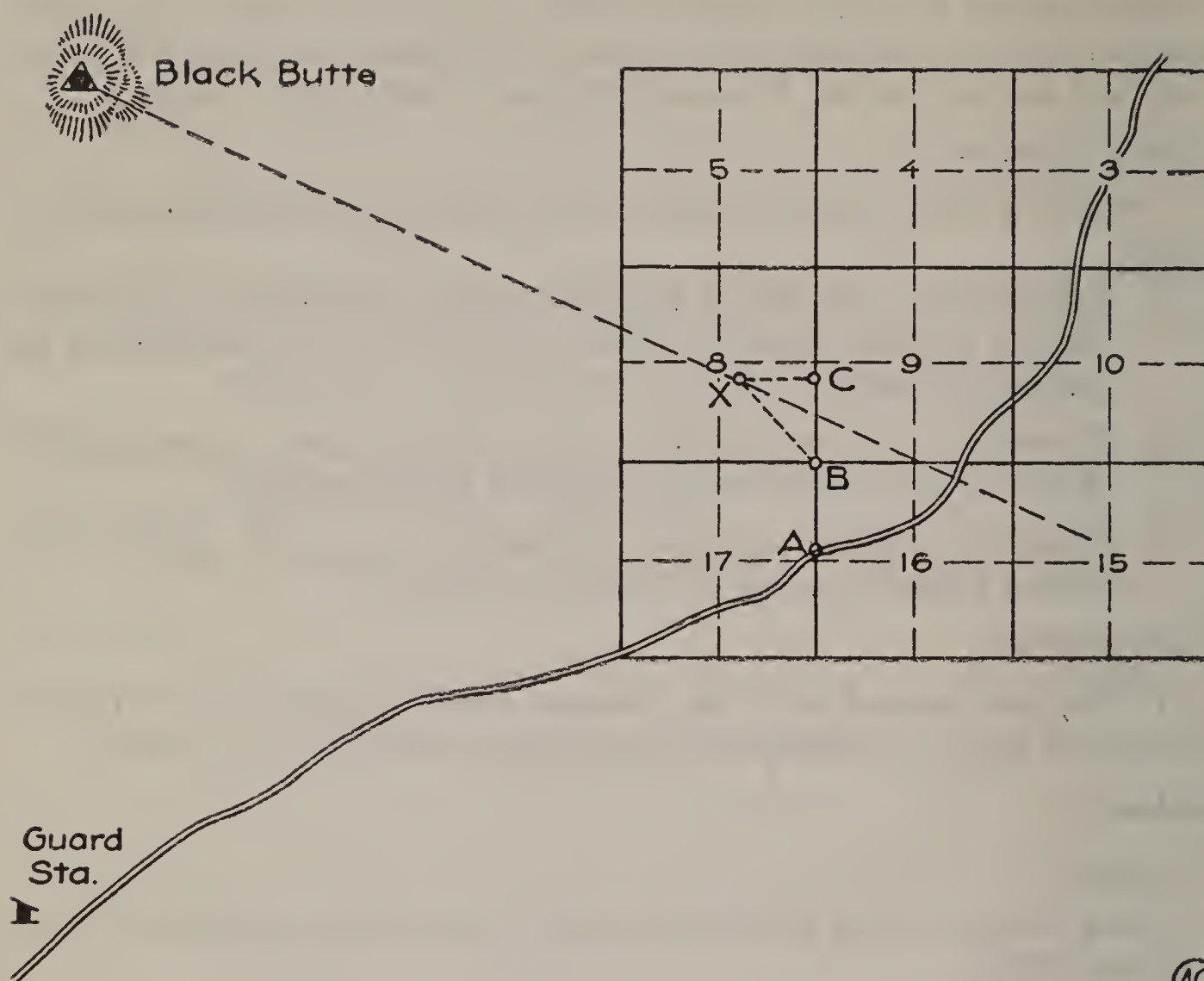
Same situation as in Problem 2, except fireman finds brush field on line B-X to be impenetrable, but easily avoided.

### *Action required*

Same as in Problem 2 to the bridge across Clear Creek. Fireman then paces down far bank of Clear Creek until he is able to get on line of sight as determined by back sight on Thomas Butte. He then proceeds on line of sight to fire, going a total of 130 chains. The additional two chains over the dispatcher's 128 chains is his own estimate of the effect of the detour.



### Problem 4:



## Condition

Fire located at X by Black Butte with cross shot. Small fire, probably difficult to find.

### Action required

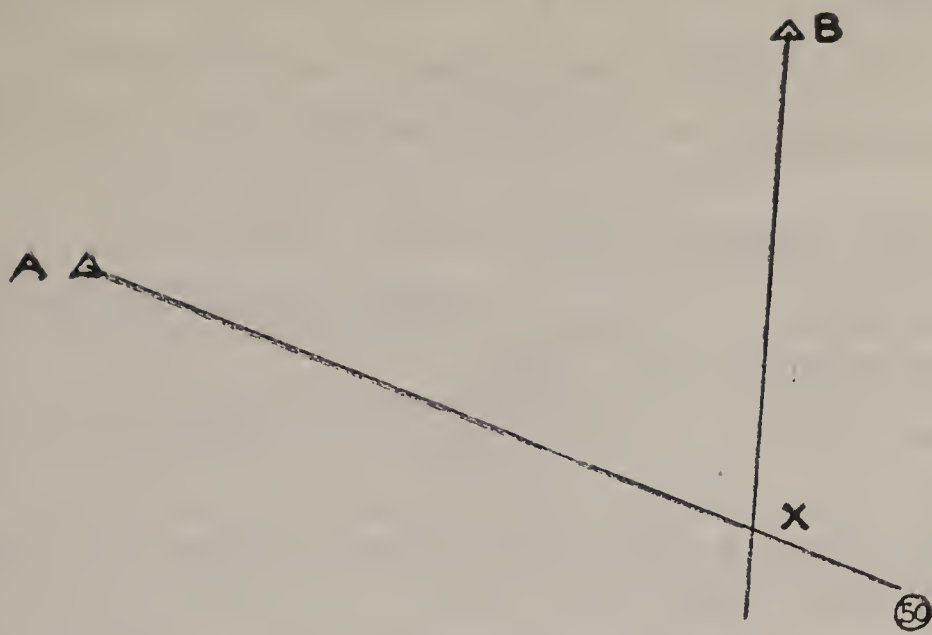
Fireman receives from dispatcher and carries out following orders:

1. Marks location of fire and line of sight on his map, writes down azimuth and back azimuth and other instructions.
2. Drives to marked roadside point A, which is on line between Sections 16 and 17.
3. Proceeds due north, pacing 38 chains to section corner at B.
4. Paces along line B-X on azimuth  $319^{\circ}$  for 50 chains to the fire.

### Alternative course

Paces due north 38 chains on line B-C, thence due west 33 chains to the fire.

**Problem 5:**



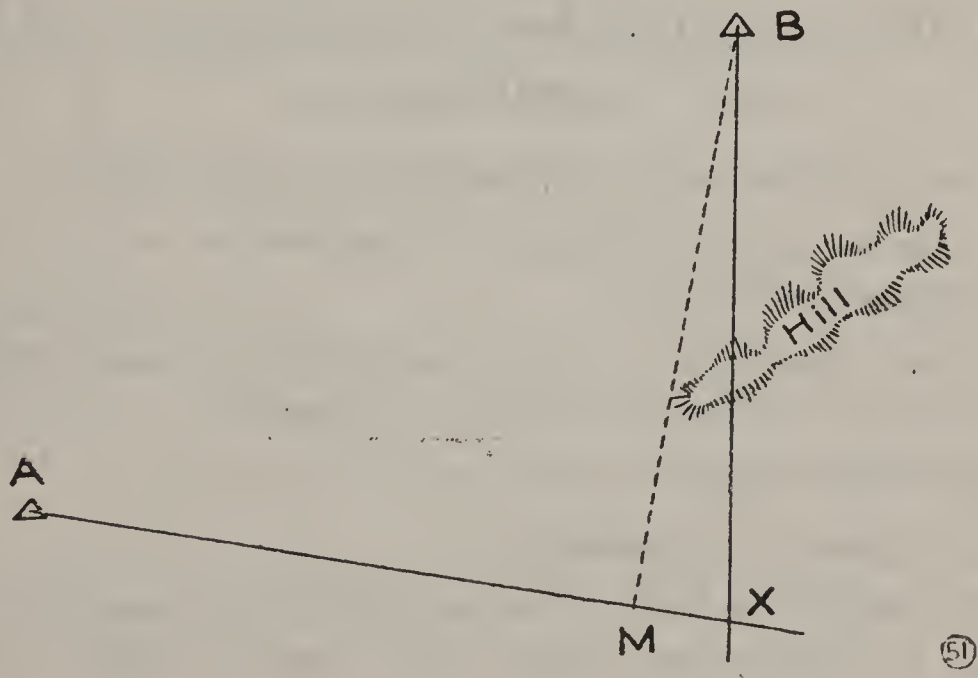
*Condition*

Fireman has been dispatched to fire at X, located on map by intersection from lookouts A and B. Has full record of instructions, including map. Has become confused en route, can't find fire, and needs to check his location. Topography level. Lookouts can be seen.

*Action required*

1. Sets up compass and backsights onto lookout A, changing position until correct back azimuth is read.
2. Proceeds similarly with lookout B, keeping on line of sight from A in the meanwhile.
3. When both backsights check with the back azimuths given him by the dispatcher, he will be at intersection indicated.

**Problem 6:**



*Condition*

Same as in Problem 5, except that end of small hill prevents back vision to lookout B from vicinity of intersection.



### *Action required*

1. Gets on line of sight from lookout A as in Problem 5.
2. Sets up compass on this line at a point where lookout B can be seen.
3. Reads back azimuth to B.
4. Obtains difference between this back azimuth and the true one provided by dispatcher (say  $11\frac{1}{2}^\circ$ ).
5. Measures distance in miles on map between B and X (say four miles).
6. Multiply  $11\frac{1}{2} \times 4 \times 92$ , which gives 552 feet as the approximate distance from M to X.
7. Proceed from M on lookout A's line of sight 552 feet to X.

NOTE:—This solution is reasonably accurate when the angle between the lines of sight from the two lookouts is within 20 degrees of a right angle. For sharper intersections, measure on map distance B-M rather than B-X, and increase calculated distance M-X approximately as follows:

| Approximate angle<br>of intersection | Increase M-X<br>by |
|--------------------------------------|--------------------|
| 65°                                  | 11%                |
| 60°                                  | 15%                |
| 55°                                  | 22%                |
| 50°                                  | 31%                |
| 45°                                  | 41%                |

### **GENERAL INSTRUCTIONS AND INFORMATION ON USE OF COMPASS**

1. Have best available unit map, in shape to carry in field.
2. Have compass in good shape, with declination set off so that zero azimuth means true north.
3. Always record and take to fire azimuth, back azimuth, distance, and other pertinent information given by dispatcher.
4. Mark calculated location of fire or fires on the map.
5. The back azimuth is obtained by:
  - a. When azimuth is  $180^\circ$  or less, add  $180^\circ$  to obtain back azimuth.
  - b. When azimuth is more than  $180^\circ$ , subtract  $180^\circ$  to obtain back azimuth.
  - c. Offset in feet (target offset) is 92 feet per degree per mile (see Problem 7). This holds reasonably accurately for all small angles.

Problem 7: Locate a specified area on a map from a written legal description.

SHOWING

Full township in center  
Township and Range Lines  
Section Lines  
Township numbers  
Range numbers  
Section numbers  
Answers to Problems 1 and 2, which follow

T.36 N.

|    |    |    |    |    |    |    |    |    |    |               |
|----|----|----|----|----|----|----|----|----|----|---------------|
| 26 | 25 | 30 | 29 | 28 | 27 | 26 | 25 | 30 | 29 |               |
| 35 | 36 | 31 | 32 | 33 | 34 | 35 | 36 | 31 | 32 |               |
| 2  | 1  | 6  | 5  | 4  | 3  | 2  | 1  | 6  | 5  | Township Line |
| 11 | 12 | 7  | 8  | 9  | 10 | 11 | 12 | 7  | 8  | Section Lines |
| 14 | 13 | 18 | 17 | 16 | 15 | 14 | 13 | 18 | 17 |               |
| 23 | 24 | 19 | 20 | 21 | 22 | 23 | 24 | 19 | 20 | T.35 N.       |
| 26 | 25 | 30 | 29 | 28 | 27 | 26 | 25 | 30 | 29 |               |
| 35 | 36 | 31 | 32 | 33 | 34 | 35 | 36 | 31 | 32 | Township Line |
| 2  | 1  | 6  | 5  | 4  | 3  | 2  | 1  | 6  | 5  | Line          |
| 11 | 12 | 7  | 8  | 9  | 10 | 11 | 12 | 7  | 8  | T.34 N.       |

R.9 E.

R.10 E.

R.11 E.

Range Lines

Problem 2

Shaded area is SWSE<sup>1</sup>/<sub>4</sub>  
Sec. 4, T.34 N., R.10 E.

Problem 1 (52)

NENW<sup>1</sup>/<sub>4</sub> Section 22  
T.35 N., R.10 E. is lo-  
cated at shaded area.

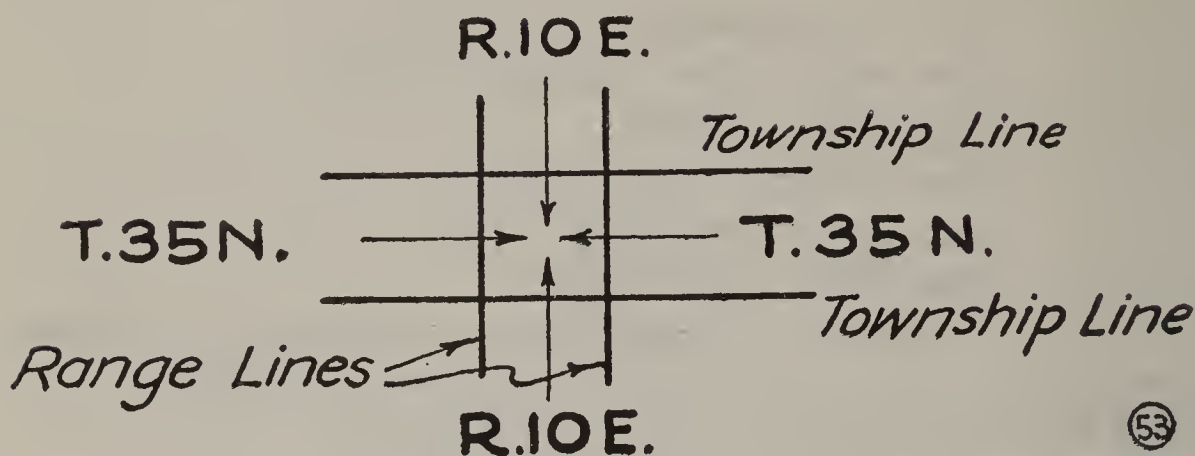
Given the legal description: Northeast Quarter of Northwest Quarter, Section 22, Township 35 North, Range 10 East (NE<sup>1</sup>/<sub>4</sub> NW<sup>1</sup>/<sub>4</sub>, Sec. 22, T. 35 N., R. 10 E.). Find this on the township plat.

Method

1. On the map find the symbol T. 35 N. (this is usually on map margin).

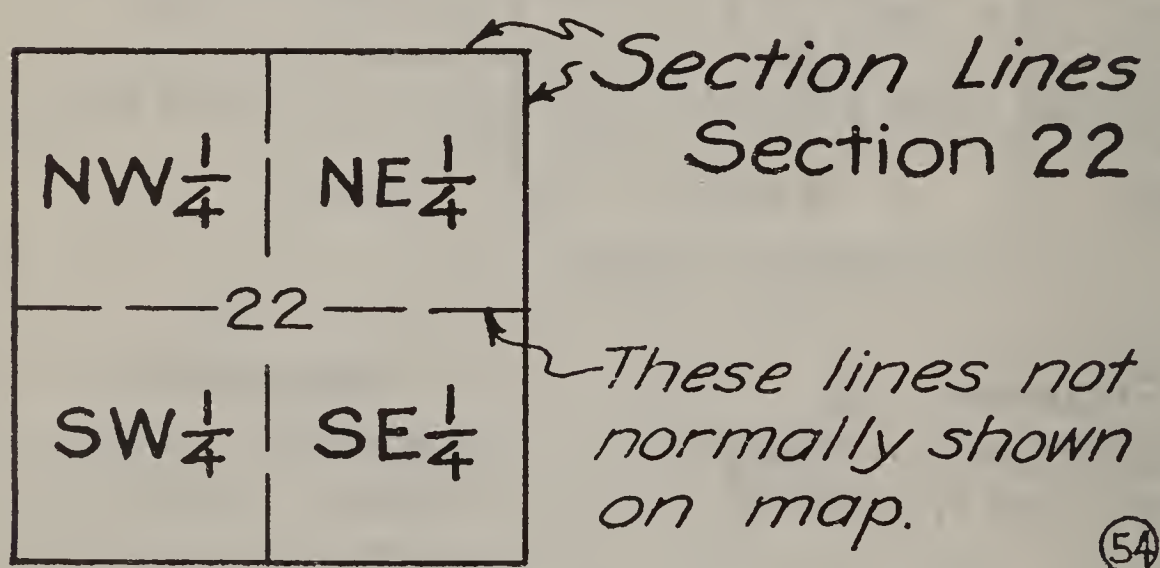


2. Follow across the map between the heavier horizontal lines until you are directly above or below a marginal symbol R. 10 E., as shown below:

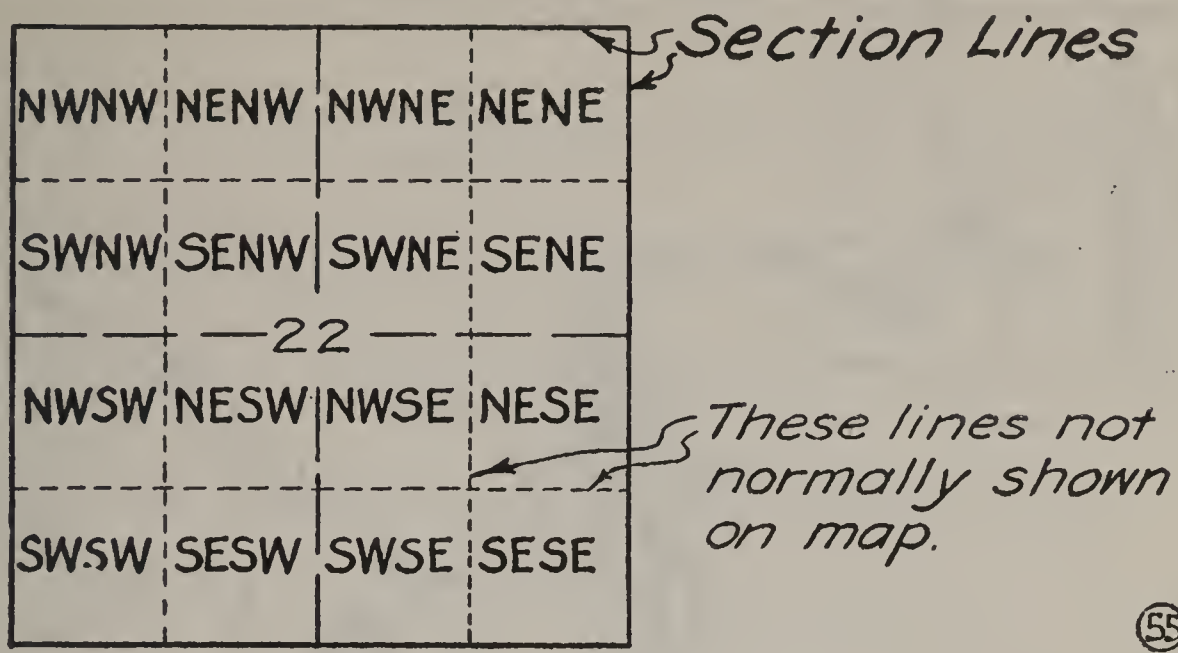


This locates block T. 35 N., R. 10 E., on the map, which is called a township.

3. Locate Section 22 by referring to plat showing the sections numbered. (In some cases the sections are numbered, and this step is not required.)
4. The section is normally a square representing one mile enclosed by lighter lines than the township and range lines.
5. *Smaller divisions:* The section is divided into quarter sections which are not shown on field map, as follows:



6. The quarter section may be subdivided further as shown below :



7. Then NE $\frac{1}{4}$  of NW $\frac{1}{4}$ , Sec. 22, T. 35 N., R. 10 E., is as indicated on township plat.

**Problem 8: Give the legal description of an area marked on the map.**

*Condition*

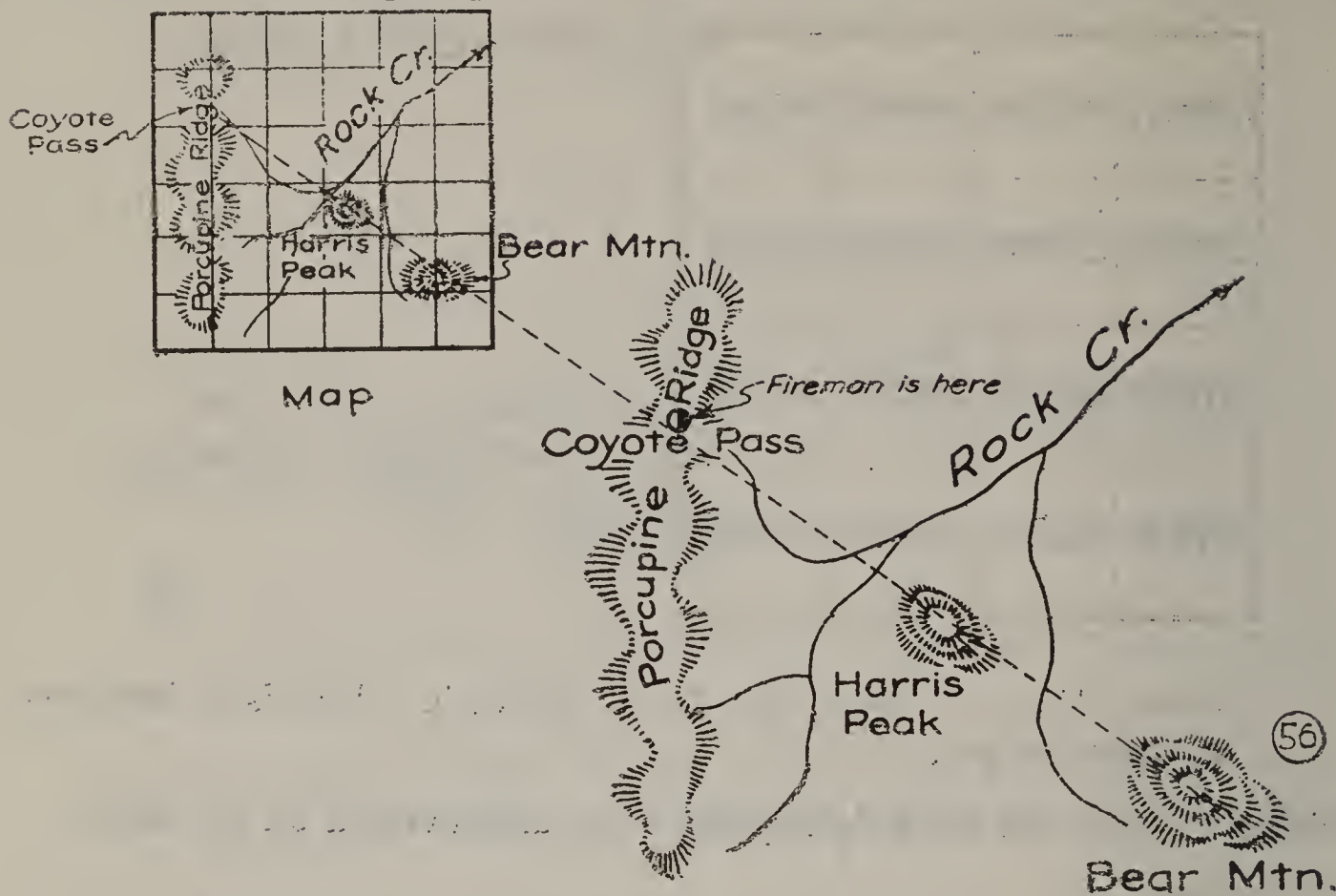
Area on map specified as shown on figure under Problem 7.

*Method*

1. Follow out to margin and get T. 34 N.
2. Follow down to margin and get R. 10 E.
3. Count sections starting at Section 1 and going to the left horizontally and get Section 4.
4. Marked location falls in SE $\frac{1}{4}$  of section and finally on the SW $\frac{1}{4}$  of the SE $\frac{1}{4}$ .
5. Area then has the written description of:  
SW $\frac{1}{4}$  SE $\frac{1}{4}$  Sec. 4, T. 34 N., R. 10 E.



### Problem 9: Orienting map without use of compass.



#### Condition

Fireman knows closely his location both on ground and map; and is familiar with certain prominent peaks, ridges, etc.

#### Action required

1. Lay map out flat with top of map in general northerly direction.
2. Fireman knows he is at Coyote Pass.
3. By looking around the country, he identifies a peak—Bear Mountain.
4. He finds Coyote Pass and Bear Mountain on the map.
5. He shifts his map until, when sighting over the map location of both Coyote Pass and Bear Mountain, the line of sight passes through Bear Mountain.
6. The map is then oriented approximately and the fireman is then able to locate other landmarks from his map by taking into account direction and distances.

### Problem 10: Locating position on map by means of topographic features.

#### Condition

Fireman does not know his location on ground or on map. He notes in looking over the country that from where he stands Harris Peak and Bear Mountain are in line. (Refer to diagram under Problem 9.) He is also able to tell he is somewhere on Porcupine Ridge.

### *Action required*

1. He finds on the map Porcupine Ridge, Bear Mountain and Harris Mountain.
2. He then draws a straight line through Bear Mountain and Harris Mountain on the map, and extends it to intersect Porcupine Ridge on the map.
3. This line passes through Coyote Pass on Porcupine Ridge. The fireman's location is therefore at Coyote Pass.
4. His map can then be oriented by the method described in Problem 9.

### **Problem 11: Determining width of fire from azimuth readings.**

1. Obtain directly from the azimuth circle of the fire finder the width of fire to the nearest  $\frac{1}{2}$  degree at its widest point.
2. Estimate the distance in miles of the fire from the lookout point, or measure this on the map if the exact location of the fire can be determined from known points.
3. Multiply the number of degrees in the reading by the miles of distance and by 92. The result is the diameter of the fire in lineal feet.

Example: Azimuth circle reading: 2 degrees

Distance to fire: 2 miles

$$2 \times 2 \times 92 = 368 \text{ feet} = \text{fire diameter}$$

### **Problem 12: Determining width of fire, using binoculars with mil-scale.**

1. Measure the distance to the object in miles on the map, and plot on the left-hand scale of the mil-scale chart. (See Appendix 14.)
2. Read the size of the object in mils through the binoculars and plot on the right-hand scale.
3. Lay a straight edge between the plotted points and read the diameter of the fire in either yards or chains on the center scale.

### **Problem 13: Determining distance of fire when size is known from binoculars with mil-scale.**

1. Convert the diameter to yards or chains and plot on center scale of mil-scale chart. (See Appendix 14.)
2. Read size of object in mils and plot on right-hand scale.
3. Lay a straight edge across the chart and read the distance on the left-hand scale.

### **GENERAL INSTRUCTIONS FOR MEASURING BURNED AREA**

1. Record acreage of all "C" fires (10 acres or over) to the nearest *whole* acre.



2. Record acreage of all fires  $1/10$  acre and up to but not including 10 acres, to nearest tenth of acre.
3. Record acreage of all fires below  $1/10$  acre in square feet.
4. Units of measurement: 1 chain = 66 feet  
10 square chains = 1 acre

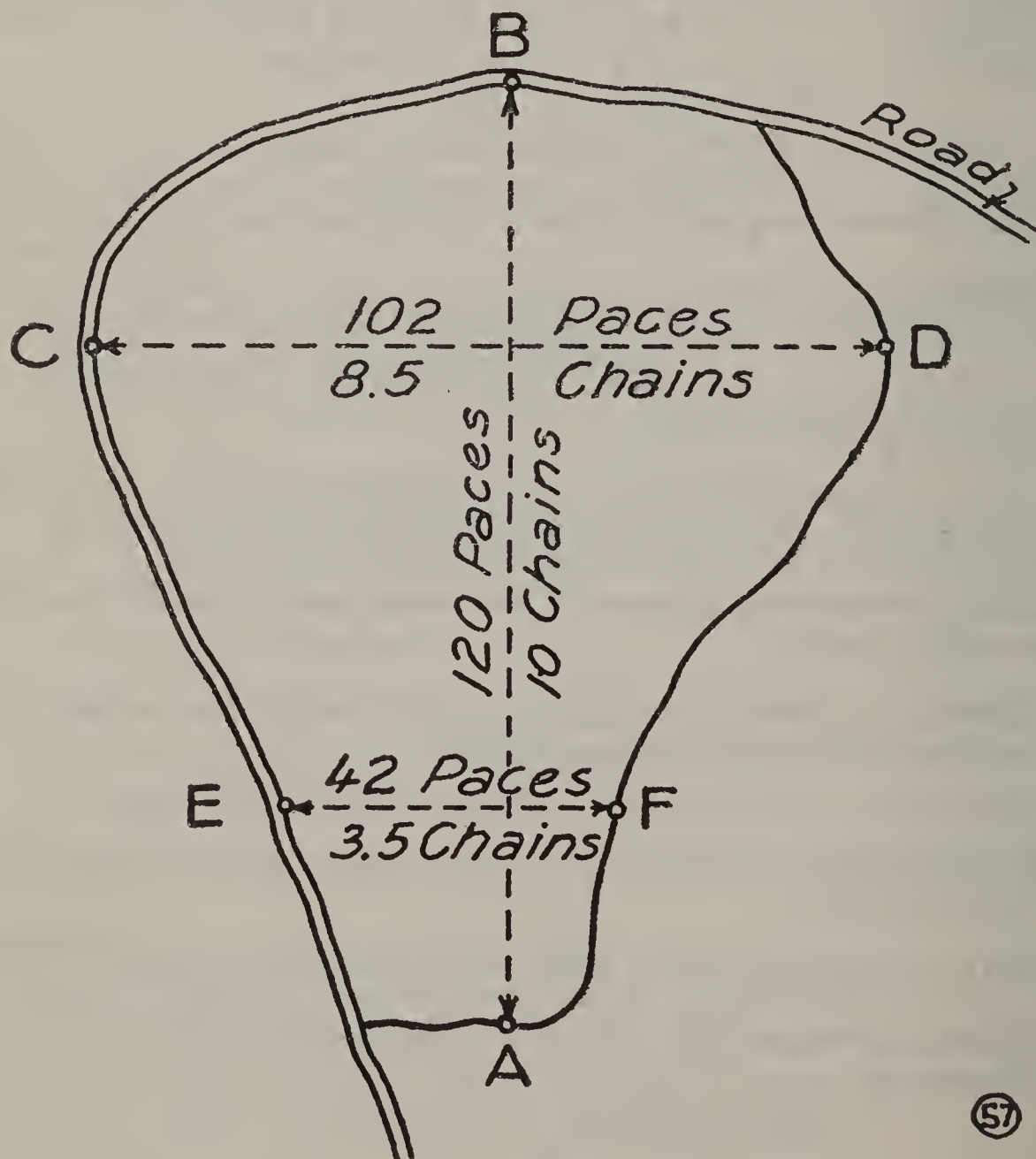
**Problem 14: To determine acreage of fires 0.1 acre or over.**

*Action required*

The fireman, after his crew has mopped up the fire, walks around and through it to size up its general shape. While doing this, he keeps in mind that he wants to get its average dimensions by pacing distances, to be used in figuring out the acreage burned to enter on his fireman's fire report.

He has previously practiced pacing over a marked course of a chain and has found that he takes twelve paces (double steps) to the chain on average ground.

He draws a rough sketch of the shape of the fire on a notebook sheet, thus:



He decides that the length of the fire is about the same any way it might be measured, so he paces the length following the line indicated as A-B on the sketch. He records the number of paces on his sketch, which, *in this case*, is 120 paces; or 120 divided by 12 equals 10 chains. He then paces across the widest portion of the fire approximately at right angles from his lengthwise paced distance; and records 102 paces, or 8.5 chains, as indicated by line C-D on the sketch. Going down to the other end of the fire, where it is the narrowest, he paces this distance and gets 42 paces, or 3.5 chains, which he records for the distance E-F. He then follows the steps listed below to determine the area:

- a. The average width equals the sum of the two measurements divided by 2.

3.5 chains = width of fire at E-F

8.5 chains = width of fire at C-D

12 chains = sum

$12 \div 2 = 6$  chains, average width

- b. The area in square chains equals the average width times length:

6 chains = average width from step (a)

10 chains = average length

$6 \times 10 = 60$  square chains = 6 acres

Methods apply to 0.1 acre and larger

**Problem 15: To determine the area in square feet of fires less than 1/10 of an acre.**

#### *Action required*

1. Guard gets a length of 14 paces and width of 7 paces.
2. Convert paces into feet, based on number of paces he takes to the chain.

Example: 12 paces = 1 chain

1 chain = 66 feet

Then one of guard's paces =  $1/12$  of 66 ft. = 5.5 ft.

3. Multiply length in feet by width in feet, which gives number of square feet:

Example: a. One of guard's paces = 5.5 feet

b. Length 14 paces.  $14 \times 5.5 = 77$  feet

c. Width 7 paces.  $7 \times 5.5 = 38.5$  feet

d. Area of fire in this example:

Width  $\times$  Length = Area

$77 \times 38.5 = 2964$  sq. ft., which should be rounded off to 3000 sq. ft. for the report.

(CAUTION: A fire 10 feet by 10 feet is sometimes spoken of as "fire 10 feet square," but its area is 100 square feet.)



# USE OF PANORAMIC PHOTOGRAPHS IN FIRE LOCATION AND DISPATCHING

## Purpose and Description

The panoramic photograph is a means to aid (1) in the location of fires and (2) in giving the dispatcher a photographic view of the topographic and cover conditions at the fire.

Each photograph carries a horizontal reference line which is at the elevation of the lookout station from which the photograph was taken. It carries on the margin the azimuth angles corresponding to the azimuth circle on the fire finder at the lookout station.

The problem in locating a fire is the simple one of finding the point on the photograph with the same azimuth and same vertical angle as those recorded by the lookout by use of his fire finder.

## Use

### 1. *The lookout*

- a. Sights the fire
- b. Determines and records the azimuth
- c. Determines and records the minus or plus vertical angle, checking his fire finder table to be sure it is level.
- d. Phones above data to dispatcher.
- e. Locates fire on his own photograph by method described below.

### 2. *The dispatcher*

- a. Records data as phoned by lookout.
- b. Places vertical scale on appropriate photograph with edge on given azimuth and zero point on horizontal reference line, being sure scale is vertical, that is, at right angles to reference line.
- c. If vertical angle is minus, as it usually is, counts downward the given number of degrees and fractions of degrees, and marks point at edge of scale. This is the location of the fire on the photograph. (If vertical angle is plus, that is, if fire is above level of the lookout, the count is made upward along the edge of the vertical scale.)

## Reliability

The greater the vertical angle, the greater the accuracy that can be expected in properly spotting the fire on the photograph. In general, the nearer the fire is to the lookout the greater is the vertical angle, and therefore the greater is the accuracy of location; and the better the clearness and detail of the photograph, the greater its value to the dispatcher.

When the lookout locates the point of the fire on his copy of the photograph, he not only is aided in learning his country but also can check

against obvious discrepancies between the plotted photograph location and the actual view as seen from his station.

**ESTIMATING FIRE DAMAGE**

- 1. Estimate damage on all Class A fires handled and all B's where damage is not great. Record, attach to Fireman's Report Form 529, and submit to Ranger.
- 2. For reproduction less than 2 inches in diameter, and by 2-inch diameter classes up to 10 inches diameter, estimate the number of small trees of each species killed or which are so badly scorched they will die. Record on notebook sheet.
- 3. For trees 12 inches or over in diameter, estimate and record on a notebook sheet the diameter breast-high the height and species of each tree.

For small B fires, involving heavy damage to mature timber or large reproduction, report to the Ranger the need for a technical examination.

**ELAPSED TIME STANDARDS**

|   |                            |
|---|----------------------------|
| <i>Discovery Time</i>   | <i>As soon as possible</i> |
| <i>Report Time to Dispatching Agency:</i>                     |                            |
| a. Forest Service lines only                                  | 2 minutes                  |
| b. Forest Service and other lines                             | 5 minutes                  |
| <i>Report Time by Dispatcher to Man Who is to go to fire:</i> | 3 minutes                  |
| <i>Get-Away Time</i>  |                            |
| a. On foot or in automobile                                   | 2 minutes                  |
| b. On saddle horse  | 5 minutes                  |
| c. With saddle and pack horse                                 | 10 minutes                 |
| <i>Travel Time</i>  |                            |
| a. On foot over good trails                                   | 3 miles per hour           |
| b. On foot across country                                     | 2 miles per hour           |
| c. On horse over good trails                                  | 3½ - 4 miles per hour      |
| d. Passenger cars or pick-ups                                 |                            |
| 1. Paved highways   | 45 miles per hour          |
| 2. Dirt or gravel, below highway standard                     | 30 miles per hour          |
| 3. One-way dirt road in flat country                          | 25 miles per hour          |
| 4. One-way dirt road in steep country                         | 15 miles per hour          |
| e. Trucks, 1½ ton   |                            |
| 1. Paved highways   | 35 miles per hour          |
| 2. Dirt or gravel, below highway standard                     | 25 miles per hour          |
| 3. One-way dirt road in flat country                          | 20 miles per hour          |
| 4. One-way dirt road in steep country                         | 12 miles per hour          |



Continuous travel, including night travel, except when dangerous even with lights ; then go as far as possible and restart at daylight.

## **PREPAREDNESS**

The guard is presumed to know that Forest Service policy and effective fire suppression demand such things as :

1. That tools and equipment are to be kept in first-class serviceable condition.
2. That failure to carry out standing instructions may lead to the loss of the fire, through failure of some unserviceable tool at the moment of need.
3. That as a representative of the United States, neatness and orderliness of himself and his station are required.

This section of the Handbook contains no lectures on the theme that preparedness is needed. Nor does it list in general terms the kind of things that are expected.

It does attempt :

1. To list the many specific details, in care of equipment, tools, station, etc., which added together mean real preparedness.
2. To provide forms and check lists to make self-inspection systematic and simple.
3. To give detailed methods of using, sharpening, and repairing the more common kinds of tools and equipment.

# GUARD'S WEEKLY INSPECTION FORM

To be used by all guards. Form provides for four weekly inspections by guard and one monthly inspection by Ranger.

|   | Guard Inspection   |  |  |  | Ranger |
|---|--------------------|--|--|--|--------|
|   | Dates and Initials |  |  |  | Date   |
| <b>A. Personal</b>  |                    |  |  |  |        |
| <b>I. Appearance</b>  |                    |  |  |  |        |
| Clean   |                    |  |  |  |        |
| Neat  |                    |  |  |  |        |
| Shaven  |                    |  |  |  |        |
| <b>II. Personal equipment required</b>                            |                    |  |  |  |        |
| a. Watch  |                    |  |  |  |        |
| Keeps correct time  |                    |  |  |  |        |
| Checked daily   |                    |  |  |  |        |
| b. Correct footwear and work clothes for fire fighting            |                    |  |  |  |        |
| Suitable  |                    |  |  |  |        |
| In repair   |                    |  |  |  |        |
| c. Uniform, hat, and badge  |                    |  |  |  |        |
| Standard  |                    |  |  |  |        |
| Presentable   |                    |  |  |  |        |
| d. Knife  |                    |  |  |  |        |
| e. Personal subsistence supplies                                  |                    |  |  |  |        |
| Sufficient for specified period                                   |                    |  |  |  |        |
| Needs listed  |                    |  |  |  |        |
| Orders placed   |                    |  |  |  |        |
| f. Personal illness or injury reported to Ranger                  |                    |  |  |  |        |
| g. Carrying case (Fire equipment)                                 |                    |  |  |  |        |
| Suitable  |                    |  |  |  |        |
| Contents checked and complete in accordance with Forest standards |                    |  |  |  |        |
| Replenished after use on fire                                     |                    |  |  |  |        |
| Ready to take to fire   |                    |  |  |  |        |
| h. Diary or daily log   |                    |  |  |  |        |
| Proper form   |                    |  |  |  |        |
| Up to date  |                    |  |  |  |        |



|  | Guard Inspection   |  |  |  | Ranger |
|--|--------------------|--|--|--|--------|
|  | Dates and Initials |  |  |  | Date   |
| i. Job list                                |                    |  |  |  |        |
| Supplied                                   |                    |  |  |  |        |
| Followed                                   |                    |  |  |  |        |
| <b>B. Station Buildings and Grounds</b>    |                    |  |  |  |        |
| <b>I. <i>Appearance and sanitation</i></b> |                    |  |  |  |        |
| a. Interior neat, clean, orderly           |                    |  |  |  |        |
| b. Windows clean                           |                    |  |  |  |        |
| c. Dishes washed and put away              |                    |  |  |  |        |
| d. Stove polished                          |                    |  |  |  |        |
| e. Bed made neatly                         |                    |  |  |  |        |
| f. Garbage can clean                       |                    |  |  |  |        |
| g. Grounds clean and neat                  |                    |  |  |  |        |
| Woodpile stacked                           |                    |  |  |  |        |
| Chips raked up                             |                    |  |  |  |        |
| Trash, cans, rubbish disposed of           |                    |  |  |  |        |
| currently                                  |                    |  |  |  |        |
| Old automobile parts and old               |                    |  |  |  |        |
| tires stored neatly                        |                    |  |  |  |        |
| h. Storeroom stock neatly shelved          |                    |  |  |  |        |
| and racked                                 |                    |  |  |  |        |
| i. Manure disposed of currently            |                    |  |  |  |        |
| where horses or livestock kept             |                    |  |  |  |        |
| j. Garbage pit                             |                    |  |  |  |        |
| Used                                       |                    |  |  |  |        |
| Cover tight                                |                    |  |  |  |        |
| Disinfected                                |                    |  |  |  |        |
| <b>II. <i>Fire prevention</i></b>          |                    |  |  |  |        |
| a. Stovepipe                               |                    |  |  |  |        |
| No holes                                   |                    |  |  |  |        |
| Joints and elbows tight                    |                    |  |  |  |        |
| b. Spark arresters                         |                    |  |  |  |        |
| On chimneys                                |                    |  |  |  |        |
| In repair                                  |                    |  |  |  |        |
| c. Stove boards                            |                    |  |  |  |        |
| Under stove                                |                    |  |  |  |        |
| Between stove and walls                    |                    |  |  |  |        |
| d. Woodbox                                 |                    |  |  |  |        |
| No rubbish                                 |                    |  |  |  |        |

|   | Guard Inspection<br>Dates and Initials |  |  |  | Ranger<br>Date |
|---|--|--|--|--|----------------|
|   |  |  |  |  |                |
| <p>Away from stove</p> <p>e. No fires started with kerosene or gasoline</p> <p>f. Flues not cracked</p> <p>g. Fire extinguisher or backpack pump<br/>Filled<br/>Handy and in designated place<br/>Emptied, dried, and stored at end of season to prevent rusting or freezing</p> <p>h. Fire ladder for roof fires at station<br/>Available<br/>In designated handy place</p> <p>i. Roof and gutters and behind chimneys clean of leaves and needles</p> <p>j. Hazards cleared from around all buildings</p> <p>k. Ashes emptied in designated safe place</p> <p>l. Gasoline and oil stored in well-ventilated storeroom. Gasoline lanterns filled outdoors</p> <p>III. <i>Improvements and facilities</i></p> <p>a. Water system<br/>Adequate<br/>No leaks in tanks, lines or faucets<br/>Pumping plant in shape<br/>Gravity system intake clear</p> <p>b. Wood or other fuel supply adequate for guard's family during his absence</p> <p>c. Station fences, corrals, and gates<br/>Stock tight<br/>In neat repair</p> |  |  |  |  |                |



|  | Guard Inspection<br>Dates and Initials |  |  |  | Ranger<br>Date |
|--|--|--|--|--|----------------|
|  |  |  |  |  |                |
| d. Other station buildings, sheds,<br>etc.<br>Weather tight<br>Theft proof (kept locked)<br>Needed repairs listed on job<br>sheet<br>e. Station signs and posters<br>Replaced when necessary<br>f. Lookout lightning protection<br>Good condition<br>g. Flag<br>Put up in morning<br>Taken down in evening or when<br>leaving station<br>Needs replacement<br>Flag pole firm, but not set on<br>building<br>Rope satisfactory<br>Rope tied to avoid loss of end<br>through top pulley                                      |  |  |  |  |                |
| <b>C. Transportation</b>   |  |  |  |  |                |
| I. <i>Automobile or truck</i>  |  |  |  |  |                |
| a. Motor clean<br>b. Oil proper level in crank case<br>c. Radiator full of water<br>d. All tires in good condition<br>e. All tires inflated<br>f. Spare tire, in good condition and<br>inflated<br>g. Tools to change tires<br>h. Gasoline tank full<br>i. Brakes effective<br>j. Lights will work<br>k. Battery charged—full of water<br>l. Recently greased<br>m. General condition<br>n. Required fire-fighting tools, in-<br>cluding filled canteen and emer-<br>gency rations, in car<br>o. Located for quick getaway |  |  |  |  |                |

|   | Guard Inspection<br>Dates and Initials |  |  |  | Ranger<br>Date |
|---|--|--|--|--|----------------|
|   |  |  |  |  |                |
| <p>II. <i>Horses or mules</i></p> <ul style="list-style-type: none"> <li>a. Good condition</li> <li>b. Shod—shoes tight</li> <li>c. Kept up during specified hours</li> <li>d. Equipment <ul style="list-style-type: none"> <li>In repair</li> <li>In place</li> <li>Saddle and blanket clean</li> <li>Ready to go</li> </ul> </li> <li>e. Filled canteen, emergency rations, with equipment</li> <li>f. Fire tools with equipment</li> <li>g. Forage supply</li> </ul> <p>D. <b>Equipment</b></p> <p>Supervisors will supply guards in charge of specialized equipment with individual check-lists to be used in its inspection, and instructions for its care and use. This includes tankers, portable pumps, fire hose, trailbuilders stationed for fire purposes, and radio.</p> <p>I. <i>Backpack pump</i></p> <ul style="list-style-type: none"> <li>a. Full of water</li> <li>b. Does it leak</li> <li>c. Gasket in cap</li> <li>d. Does pump work freely or is barrel gummy</li> <li>e. Shoulder straps O. K.</li> <li>f. Condition of hose</li> </ul> <p>II. <i>Blankets, comforters or kapoks</i></p> <ul style="list-style-type: none"> <li>a. Are they stored properly</li> <li>b. Are they clean</li> </ul> <p>III. <i>Canteens</i></p> <ul style="list-style-type: none"> <li>a. Condition of cover</li> <li>b. Is cover stenciled</li> <li>c. Does it leak</li> <li>d. Condition of cap gasket</li> <li>e. Condition of cap</li> <li>f. Full of water</li> </ul> |  |  |  |  |                |



|   | Dates and Initials<br>Guard Inspection |  |  |  | Ranger<br>Date |
|---|--|--|--|--|----------------|
|   |  |  |  |  |                |
| IV. <i>Gasoline lantern</i>   |  |  |  |  |                |
| a. Is bowl tight and without make-shift plug                                      |  |  |  |  |                |
| b. Does pump work   |  |  |  |  |                |
| c. Are mantles attached but unburned  |  |  |  |  |                |
| d. Is assembly complete   |  |  |  |  |                |
| e. Spare mantles  |  |  |  |  |                |
| f. Spare generator tip  |  |  |  |  |                |
| g. Tools for lantern  |  |  |  |  |                |
| h. Extra fuel available   |  |  |  |  |                |
| V. <i>Emery wheels</i>  |  |  |  |  |                |
| a. Are they worn out of shape   |  |  |  |  |                |
| b. Are they cracked   |  |  |  |  |                |
| c. Condition of mandrel   |  |  |  |  |                |
| VI. <i>Files</i>  |  |  |  |  |                |
| a. Are they worn out  |  |  |  |  |                |
| b. Handles provided   |  |  |  |  |                |
| c. Supply adequate  |  |  |  |  |                |
| VII. <i>Flame thrower</i>   |  |  |  |  |                |
| a. Equipped with check valve  |  |  |  |  |                |
| b. Right type gaskets   |  |  |  |  |                |
| c. Does tank leak   |  |  |  |  |                |
| d. Jets on hand   |  |  |  |  |                |
| e. End of jet temporarily plugged to prevent loss of fuel while traveling to fire |  |  |  |  |                |
| f. Is outfit plainly marked to prevent possible misuse                            |  |  |  |  |                |
| g. Spare wicking on hand  |  |  |  |  |                |
| h. Carrying harness O. K.   |  |  |  |  |                |
| i. Hose connections tight   |  |  |  |  |                |
| j. Right kind of fuel on hand   |  |  |  |  |                |
| VIII. <i>Hauck torch</i>  |  |  |  |  |                |
| a. Tank tight   |  |  |  |  |                |
| b. Will pump work   |  |  |  |  |                |
| c. Right gaskets used   |  |  |  |  |                |
| d. Hose connection tight  |  |  |  |  |                |
| e. Jets for generator on hand   |  |  |  |  |                |

|  | Guard Inspection   |  |  |  | Ranger |
|--|--------------------|--|--|--|--------|
|  | Dates and Initials |  |  |  | Date   |
| f. Right fuel on hand                              |                    |  |  |  |        |
| IX. <i>Headlamps, electric</i>                     |                    |  |  |  |        |
| a. Batteries in container                          |                    |  |  |  |        |
| b. Batteries in container shielded                 |                    |  |  |  |        |
| c. Condition of cord                               |                    |  |  |  |        |
| d. Spare bulb                                      |                    |  |  |  |        |
| e. Will lamp work                                  |                    |  |  |  |        |
| f. Extra battery supply                            |                    |  |  |  |        |
| X. <i>Improvement tools</i>                        |                    |  |  |  |        |
| Check same as for fire stock                       |                    |  |  |  |        |
| XI. <i>Mess outfits</i>                            |                    |  |  |  |        |
| a. Clean   |                    |  |  |  |        |
| b. Packed properly                                 |                    |  |  |  |        |
| c. Complete  |                    |  |  |  |        |
| XII. <i>Milk cans</i>                              |                    |  |  |  |        |
| a. Rust free                                       |                    |  |  |  |        |
| b. Serviceable                                     |                    |  |  |  |        |
| c. Clean   |                    |  |  |  |        |
| XIII. <i>Osborne and Bosworth fire finders</i>     |                    |  |  |  |        |
| a. Oriented with respect to topography             |                    |  |  |  |        |
| b. Sights plumb                                    |                    |  |  |  |        |
| c. Sighting hairs tight                            |                    |  |  |  |        |
| d. Map oriented with respect to azimuth graduation |                    |  |  |  |        |
| e. Fire finder level                               |                    |  |  |  |        |
| f. Condition of map                                |                    |  |  |  |        |
| g. Carriage oiled                                  |                    |  |  |  |        |
| h. General condition of instrument                 |                    |  |  |  |        |
| i. Orientation record posted and available for use |                    |  |  |  |        |
| XIV. <i>Telephone</i>                              |                    |  |  |  |        |
| a. Connections tight                               |                    |  |  |  |        |
| b. Protection blocks clean                         |                    |  |  |  |        |
| c. Telephone call chart up                         |                    |  |  |  |        |
| d. Ground O. K.—soldered                           |                    |  |  |  |        |
| e. Remote telephone switch O. K.                   |                    |  |  |  |        |
| XV. <i>Tool cache card</i>                         |                    |  |  |  |        |
| Is it used and up to date                          |                    |  |  |  |        |



# E. Tools

|                             | BLADE OR HEAD |        |               | HANDLE |                   |          |        | Branded       |       | TEETH |         | BLADE | STRIKING FACE |           |     |
|-----------------------------|---------------|--------|---------------|--------|-------------------|----------|--------|---------------|-------|-------|---------|-------|---------------|-----------|-----|
|                             | Sharp         | Temper | Branded R. S. | Tight  | Cracked or Broken | Straight | Smooth | Properly Hung | Paint | USFS  | Missing | Sharp | Kinks         | Dog-Eared | Eye |
| Axe.....                    | XXX           |        | XXX           | XXX    | XXX               | XXX      | XXX    | XXX           | XXX   | XXX   |         |       |               |           | XXX |
| Brush hook.....             | XXX           |        | XXX           | XXX    | XXX               | XXX      | XXX    | XXX           | XXX   | XXX   |         |       |               |           | XXX |
| Brush knife.....            | XXX           |        | XXX           | XXX    |                   |          | XXX    | XXX           |       |       |         |       |               |           |     |
| Hoe, hazel.....             | XXX           |        | XXX           | XXX    |                   | XXX      | XXX    | XXX           | XXX   | XXX   |         |       |               |           | XXX |
| McLeod.....                 | XXX           |        | XXX           | XXX    |                   | XXX      | XXX    | XXX           | XXX   | XXX   | XXX     | XXX   |               |           | XXX |
| Pulaski.....                | XXX           |        | XXX           | XXX    | XXX               | XXX      | XXX    | XXX           | XXX   | XXX   |         |       |               |           | XXX |
| Rake, asphalt.....          |               |        |               | XXX    |                   | XXX      | XXX    | XXX           | XXX   | XXX   | XXX     |       |               |           |     |
| Saw, felling, crosscut..... |               |        | XXX           |        |                   |          |        |               |       |       |         | XXX   |               |           |     |
| Saw handle.....             |               |        |               |        |                   |          |        |               | XXX   | XXX   |         |       |               |           |     |
| Shears, pruning.....        | XXX           |        | XXX           | XXX    |                   |          | XXX    | XXX           | XXX   | XXX   |         |       |               |           |     |
| Shovel.....                 | XXX           | XXX    | XXX           | XXX    | XXX               | XXX      | XXX    | XXX           | XXX   | XXX   |         |       | XXX           |           |     |
| Sledge.....                 |               |        | XXX           | XXX    | XXX               | XXX      | XXX    | XXX           |       |       |         |       |               | XXX       |     |
| Wedge.....                  |               |        | XXX           |        |                   | XXX      |        |               | XXX   | XXX   |         | XXX   |               | XXX       |     |

NOTE: xxx—Points to check.

TOOLS AND EQUIPMENT

LOCATION MONTH

NAME

FOREST

| CLASS OF TOOLS AND EQUIPMENT | Date<br>Guard's<br>Initials               | Date<br>Guard's<br>Initials               | Date<br>Guard's<br>Initials               | Date<br>Guard's<br>Initials               | Date<br>Ranger's<br>Initials              | Date<br>Other's<br>Initials               |
|------------------------------|---|---|---|---|---|---|
|                              | All Checked<br>Number Un-<br>satisfactory | All Checked<br>Number Un-<br>satisfactory | All Checked<br>Number Un-<br>satisfactory | All Checked<br>Number Un-<br>satisfactory | All Checked<br>Number Un-<br>satisfactory | All Checked<br>Number Un-<br>satisfactory |
| Axes                         |   |   |   |   |   |   |
| Backpack pump                |   |   |   |   |   |   |
| Blanket                      |   |   |   |   |   |   |
| Brush hooks                  |   |   |   |   |   |   |
| Brush knives                 |   |   |   |   |   |   |
| Canteens                     |   |   |   |   |   |   |
| Emery wheel                  |   |   |   |   |   |   |
| Extra batteries              |   |   |   |   |   |   |
| Files                        |   |   |   |   |   |   |
| Fire finder                  |   |   |   |   |   |   |
| Flame thrower                |   |   |   |   |   |   |
| Hauck torch                  |   |   |   |   |   |   |
| Headlamps, electric          |   |   |   |   |   |   |
| Hoes, hazel                  |   |   |   |   |   |   |
| Lantern, gasoline            |   |   |   |   |   |   |
| McLeod tools                 |   |   |   |   |   |   |
| Mess outfit                  |   |   |   |   |   |   |
| Milk cans                    |   |   |   |   |   |   |
| Rakes, asphalt               |   |   |   |   |   |   |
| Saw, crosscut                |   |   |   |   |   |   |
| Saw, felling                 |   |   |   |   |   |   |
| Saw handles                  |   |   |   |   |   |   |
| Shears, pruning              |   |   |   |   |   |   |
| Sledges                      |   |   |   |   |   |   |
| Telephone                    |   |   |   |   |   |   |
| Wedges                       |   |   |   |   |   |   |



# SAFETY FIRST

Instruct men and take precautions to prevent all possible accidents ; if any are incurred, treat injuries promptly and properly.

## How to Prevent Injuries or Sickness

1. Do not let men carrying sharp-edged tools walk close together. Have men carrying saws last in line.
2. Do not carry sharp-edged tools on shoulders.
3. Do not swing sharp cutting tools close enough to others to endanger them.
4. When chopping, look out for overhanging limbs or interfering brush.
5. Look out for falling timber or falling limbs.
6. Drink water slowly if overheated.
7. Eat no partly decayed or peculiar-tasting food.

## If Injuries Do Occur

1. Get medical attention as soon as possible for all severe cases.
2. Give first aid promptly in all cases of injuries or serious illness.

## First Aid (\* Immediate action imperative)

### 1. *Burns \**

Cut off loose clothing and soak off the rest. Do not pull. Apply sterile gauze soaked in solution of : 1 tablespoon baking soda and 2 tablespoons epsom salts in 1 pint of warm boiled water. Keep moist.

### 2. *Bites, Insect*

Apply cool, moist baking soda compress, using sterilized gauze and water.

### 3. *Broken Bones \**

Carefully move patient to more comfortable position. Get physician if possible before moving more. If absolutely necessary to transport, put on splints.

### 4. *Cuts \**

See Wounds for procedure.

### 5. *Overcome by Smoke \**

Get immediately into clear air. Administer artificial respiration if necessary.

### 6. *Poison Oak*

Wash exposed parts with warm soap suds ; and, if available, cleanse with rubbing alcohol.

### 7. *Poisons, Internal \**

Try to induce vomiting at once and repeatedly with :

- a. Ordinary soap suds.
- b. Salt water.
- c. Baking soda in water.
- d. Fingers tickling throat if necessary.

After stomach is well cleared out, give large dose of epsom salts.  
Drink milk.

## 8. *Shock* \*

Follows soon after most accidents. Symptoms are: pale face, cold sweat, cold skin, pulse fast but weak, may have cramps, "all in." In cases of head or upper body injury, sun or heat stroke, lay patient down with head higher than feet. Give no stimulants. Apply cold rather than heat, and give cold drinks.

In all other cases, lay patient down with head a little lower than feet. Wrap warmly, apply heat to feet, between thighs, beside body or abdomen. If conscious, give hot drink of coffee, tea, or water; one cup every half-hour.

## 9. *Snake Bite* \*

1. Keep person quiet with bitten part elevated.
2. Apply tourniquet immediately above bite. Loosen this for few minutes every half-hour.
3. Make cross-cut incision over each fang mark.
4. Induce free, moderate bleeding.
5. Apply suction with suction cup or by mouth, if no wounds or sores in mouth.

## 10. *Sprains*

1. Elevate injured limb.
2. Apply cold or hot compresses.
3. Treat for shock, if present.

## 11. *Wounds* \* (Not bleeding freely)

1. Clean if needed with rubbing alcohol, coal oil, benzine, naphtha, or high-test gasoline.
2. Induce moderate bleeding.
3. Apply 3½ per cent solution iodine, *once only*.
4. Let dry and apply sterile dressing and bandage.  
(Can use table salt as disinfectant.)
5. Do not touch with hands.

## 12. *Wounds, Artery* \*

1. Apply large bandage dressing directly over wound.
2. Apply finger pressure over artery.
3. Apply tourniquet over external pressure point, loosening this for few moments at least every half-hour.



## Lookout Safety Rules

### 1. *Precautions against lightning*

All houses and towers located on points that are exposed to lightning must be equipped with the standard Forest Service protection approved by the Bureau of Standards.

All lookouts should be supplied with glass-legged stool on which to stand during severe lightning storms, particularly while telephoning when active lightning is near their stations and likely to come in on the wires.

Do not use the telephone while the storm is very close or overhead. Throw out the line switches during such periods, being sure to re-establish communication as soon as the danger is over.

Put out fires in stoves when severe storms are approaching.

Stay inside of the protected houses rather than to go out of doors.

Keep away from contact with wires or metal objects even though they are insulated.

If caught out of doors, seek the protection of the dense timber, caves, deep canyons or overhanging cliffs, if any are available.

See that a copy of the Standard Rules is kept posted in each lookout or exposed building.

Keep remote safety switch on telephone line open during severe and nearby lightning storms. Use rope (not wire) for control of switch from catwalk.

### 2. *Precautions against falls*

a. Use a flashlight or lantern when going up or down stairs at night.

b. Keep inside trap doors to stairs closed except when stairs are in actual use.

c. Keep catwalk trap doors closed except during heavy visiting periods. When catwalk trap doors are open, be sure the bar at the open end of the stair well is in a safety position.

d. Warn visitors of the danger of falls, and see that children are not allowed on catwalk unattended.

e. Keep catwalks and stairs absolutely free of chairs, boxes, tools, or any objects whatever.

### 3. *Precautions against fire.*

a. Fill gasoline lanterns outside.

b. Have definite daylight hour for filling gas lanterns. Never fill when lighted or warm.

c. If gasoline or kerosene stove is used, fill detachable reservoirs outside. In filling other types, be sure room is well ventilated.

d. Do not use inflammable cleaning fluid inside.

- e. Dispose currently of all oily rags.
- f. Keep fire extinguisher or backpack pump filled and ready for use.
- g. Observe standard instructions in the storage of gasoline and the filling of car gasoline tanks.
- h. Keep storage room clean and neat. Avoid accumulations of old newspapers, magazines, sacks, rags, paint cans, etc.

## **PREVENTION**

The guard's chief opportunity to prevent fires is in his contacts with forest users. To obtain the desired result of greater care in use of fire requires the same method of resolving problems into their elements and finding a solution for each that has been set forth as applying to fire suppression and preparedness.

This section attempts to give a basis for such analyses; and to indicate through specific examples a general method of approach, the proper attitude on the part of the guard and how to handle contacts effectively.

### **FIRE PREVENTION THROUGH PUBLIC CONTACT**

To prevent a fire there must be on the part of the Forest user: (1) an incentive or interest, and (2) the knowledge of what to do or not to do.

#### **INCENTIVES AND THEIR STIMULATION**

The principal incentives to fire prevention that can be expected to influence, either singly or in various degrees collectively, the National Forest users are grouped as follows:

1. Esthetic or emotional reaction against fire as a destructive force.
  - a. Effects of fire on scenery, roadside beauty, stream side environment, etc.
  - b. Disagreeable effects of smoke clouds.
  - c. Effects on deer and other wild life.
  - d. Terrifying effect of large fires.
2. Appreciation of the community values at stake and of the damage that fires do to them.
  - a. Function of local supplies of timber as a resource that maintains industry, payrolls and homes.
  - b. Local economic value of recreation, as shown by presence of resorts, stores, gas stations, etc., and how fires affect them.
  - c. Function of local streams for water power and irrigation either locally or in valley below.
  - d. Erosion and flood damage to roads, habitations or farm lands.
  - e. Local aspect of fire damage to grazing resource.
3. Selfish, that is, personal interest in a forest property or service.



- a. Interest as a forest property owner in specific fire dangers and damage.
- b. Interest as a user of favorite camp grounds, fishing streams; hunting grounds, trails, lakes, etc.
- c. Desire for safety of self and friends.
4. Respect for and acceptance of fire laws and regulations, or fear of arrest for violations.
  - a. Good citizenship demands law compliance.
  - b. Knowledge of existence and meaning of fire laws.
  - c. Impartial law enforcement in the event of violation.
5. Respect for and desire to aid the Forest Service because it is considered a well-informed and competent public agency with a genuine desire to give public service. This demands of the Forest officer:
  - a. Knowledge of job as shown by evident willingness and ability to answer questions and give incidental services.
  - b. Ability to explain simply but clearly the general purposes of forest protection, methods used, and need for fire protection, as guided by the specific interest of the listener.
  - c. Spirit of helpfulness.
  - d. Courtesy under all conditions.
  - e. Restraint of personal reactions, such as anger and impatience, even under trying conditions.
  - f. Diplomatic but firm enforcement of law violations.
  - g. Avoidance of attitudes (often unconscious) that are distasteful to others, such as being hard-boiled or superior.
  - h. Readiness to render aid in all emergencies.
6. Affection or respect for individual members of the personnel. This demands:
  - a. All those actions and qualities listed under (5) above.
  - b. A sincerely friendly and helpful interest in others.

## **FIRE DANGERS AND PREVENTION PRACTICES WHICH SHOULD BE MADE KNOWN TO FOREST USERS**

1. Camp fire risks
  - a. When prohibited.
  - b. What constitutes a safe place.
  - c. How to make safe.
  - d. Away from heavy fuel.
  - e. No larger than necessary.
  - f. Extinguish before leaving.
  - g. Permits; shovel and axe.
  - h. What to do if one escapes.

2. Smoking risks
  - a. Where permitted and prohibited.
  - b. When is a match out.
  - c. What to do with pipe heels and cigar butts.
  - d. What to do with cigarette stubs.
3. Cabin hazards and risks
  - a. Safety flues and spark arresters.
  - b. Hearth screens.
  - c. Clean roofs.
  - d. Matches in covered metal container.
  - e. Keep matches from children.
  - f. Bonfires, washing fires, etc.
  - g. Surroundings clear of dry grass, rotten wood, etc.
  - h. Care in refuse burning.
  - i. Safe storage and use of gasoline.
  - j. Removal of litter, old newspapers, oil rags, etc.
  - k. Electric wiring safely installed.
  - l. Care in use of lamps and candles.
4. Industrial hazards and risks
  - a. Prevention equipment for steam boilers.
  - b. Spark arresters for gasoline engines.
  - c. Care in refuse and debris burning.
  - d. Burning permit requirements.
  - e. Abatement of woods hazards.
  - f. Abatement of structural hazards. (See No. 3 above.)
  - g. Control of employees, smoking in woods, etc.

## **PROBLEMS IN PUBLIC CONTACTS**

**Problem 1: A Forest visitor drives up to a Guard Station and enters, to obtain camp fire permit. (See Appendix 9 for dialogue covering action.)**

### *Action required*

Visitor asks for permit. Guard welcomes him pleasantly, places chair at table and provides permit form. Visitor asks whether small children count as members of party; guard explains why they do. Visitor has not heard of shovel and axe regulations; guard explains need for use around camp and to suppress small fires discovered. Visitor has no shovel and axe and asks whether necessary to return a long distance to town; guard finds out where visitor is headed; calls country store on visitor's route to find out if tools available and tells visitor how to find store. Visitor asks about fishing; guard refers him to patrolman at destination. Visitor leaves; guard telephones patrolman and asks him to check on visitor's shovel and axe on arrival.



**Problem 2: Forest patrolman finds camper along a side road, with camp fire recently built against a log.**

*Action required*

Guard asks camper what his plans are for putting out his camp fire when he leaves camp. After the usually ineffective answer, guard courteously drives home point that such a camp fire is hard to extinguish. Guard asks camper for his camp fire permit and points out that the practice of building a fire against a log is forbidden. Guard guides camper in selecting a safe place for a new fire and has him extinguish old one, using camper's shovel and axe. Guard demonstrates their use. Guard points out how far fire has already eaten into rotten log; and had it burned for an hour or two, it might have gotten away and certainly would have been very difficult to put out completely.

**Problem 3: Patrolman finds camp fire left burning in camp along a canyon road. An automobile, camp gear, shovel and axe, but no persons, are in camp.**

*Action required*

Guard makes sure that fire will not escape, then notes name of car owner and license number. After a short wait, a man comes into camp with a string of fish. Guard secures man's name, which is the same as that given on the car registration certificate. Guard asks him for his camp fire permit, and has him read it aloud. Points out to him firmly but quietly that he has violated the law in leaving his camp fire unattended. Guard courteously tells him that he has no option but to give him a citation, which he does.

*Supplemental*

If the man claims he left the camp fire supposedly out, guard finds out exactly what was done, and then shows him proper method of putting out a fire thoroughly, using the man's camp fire for demonstration purposes. Guard usually gives citation.

**Problem 4: Patrolman inspects fisherman's camp along a stream. Finds camp fire cold, camp in neat shape; water bucket and wash basin on log at some distance from stream, shovel and axe in camp.**

*Action required*

Guard leaves copy of inspection report on table, complimenting camper on dead camp fire, neatness of camp, and provisions against stream contamination. If camper is present, guard expresses appreciation verbally.

**Problem 5: Man and woman visit a lookout station from which a fine view is available.**

*Action required*

Guard welcomes them and notes by their first few remarks that they are interested in scenery and topography. Visitors start to look around, which guard allows them to do undisturbed while he makes his regular systematic check in all directions for fires. Guard then offers them information about names and heights of peaks, names of rivers, etc., using fire finder to point out the less conspicuous points mentioned. Guard then makes another systematic search for fires. Visitors become interested in fire finder and its use. Guard explains use in determining direction to fires and how dispatcher uses telephoned information for locating fires by intersection. Guard makes another systematic survey for fires. Visitors still interested, so guard points out burns with interesting history; tells how they could have been prevented, why they became large, and damage done, specifically, as to losses of timber, watershed, etc.

*Supplemental*

The procedure will vary with local conditions, but always:

1. Start with evident interests of visitor (it might be game, fish, look-out life, etc.).
2. Maintain normal watch for fires.
3. Lead up to fire discussion of local interest and importance.

**SUMMARY OF PRINCIPLES AND PRACTICES IN  
PUBLIC CONTACT**

1. Keep person and quarters neat and orderly.
2. Speak and act pleasantly and courteously.
3. Show a willingness to be helpful.
4. Give information cheerfully and, if not available, try to get it or give sources where the visitor may go to get it.
5. Avoid allowing personal reactions, such as anger and impatience, to influence your appearance and conduct.
6. When it is necessary to say "no" do so quietly but firmly; and explain reasons.
7. Avoid appearances of being hard-boiled or superior.
8. Take an active interest in the other fellow's problems and viewpoint—a necessary step to introducing your own.
9. In law enforcement, be courteous and impartial, but firm.
10. Know your job and how to describe its interesting features and its purposes.
11. Whenever practicable, demonstrate, rather than merely describe, good fire prevention practices.



# **SUMMARY OF PRINCIPAL DUTIES AND JOBS OF FOREST GUARDS REGISTRAR**

## **Prevention**

- Check for compliance with shovel and axe requirement and camp fire permit.
- Inform visitors concerning smoking rules.
- Emphasize care with fire.
- Give visitors desired information, such as location of camping places.
- Stimulate interest in forests.
- Keep registration records as instructed.
- Keep daily record and reports on work done.

## **Preparedness**

- Keep station and equipment in orderly and usable condition.

## **Suppression**

- Handle fire suppression as required by Forest Fire Plan or by order of superior officer.

# **LOOKOUT**

## **Prevention**

- Give all visitors full information and stimulate interest in Service.
- Issue camp fire permits.
- Keep visitors' register.
- Take and record weather data required in Forest Plan.

## **Preparedness**

- Occupy post of duty during hours specified in Forest Plan and at other times requested by dispatcher.
- Cover systematically entire visible area not less than four times each hour.
- Take quick looks between systematic coverages, particularly at dangerous areas.
- Keep station and equipment in an orderly, usable and clean condition.
- Make periodic condition inspection as required in Forest Plan.
- Keep the specified amounts of food supplies, fuel and water on hand at all times.
- Make emergency repairs to telephone lines in case of breaks as specified in Forest Plan.

## **Suppression**

- Locate accurately, record and report promptly all fires discovered in the detail and manner specified in the Forest Plan.

Make special check observations as called for by dispatcher on fires reported by other agencies.

Give follow-up reports to dispatcher as to apparent success of control action and excessive rates of spread of fires reported.

Give reports whenever material changes occur in appearance of large fires to assist the dispatcher in planning action.

Report promptly location of breaks in control lines on large fires.

Make a detailed record by location of all lightning strikes.

Watch the location of all strikes for several succeeding days.

Watch in the vicinity of recognized industrial smokes, particularly at time of bad burning conditions.

Go to and suppress fires when ordered to do so by dispatcher.

## **LOOKOUT-FIREMAN**

Duties while at station are same as those of lookout ; while acting as fireman, has duties of that nature, as listed hereafter.

### **FIREMAN**

#### **Prevention**

Give all visitors full information desired and stimulate interest in fire prevention.

Issue camp fire permits.

Take and record weather data if required by Forest Plan.

Keep daily record of work done and other records required by Forest Plan.

Post and tear down signs as instructed.

Observe and enforce fire regulations and laws.

#### **Preparedness**

Keep station tools and equipment in an orderly, usable, and clean condition at all times.

Carry outfit specified in Forest Plan at all times.

Keep specified emergency equipment in instant readiness for departure.

Make test telephone calls as specified in Forest Plan.

Make emergency repairs to telephone lines in case of breaks as specified in Forest Plan.

Keep specified amounts of fuel, food and water on hand at all times. Handle other special jobs, such as servicing lookouts, set up for the position in the Forest Plan.

#### **Suppression**

Suppress all fires found while on field trips.

Suppress all fires assigned for action in shortest practicable time.

Perform continuous night or day travel to fires.

Make Form 592 reports and other records on all fires suppressed.

Handle jobs assigned on project fires.



## **SUPPRESSION FOREMAN**

### **Prevention**

Keep daily record of work done.

No other specific prevention duties except as assigned in individual instructions or special orders.

### **Preparedness**

Train crew in organization, use of equipment, and fire suppression methods.

Develop crew spirit.

Maintain quarters in clean and orderly condition.

Inspect equipment and require that it be kept up to a high standard.

### **Suppression**

Handle small fires with crew.

Serve as assigned on large fires.

Make reports on small fires on Form 592.

Keep other records and prepare reports as specified in Fire Plan.

## **PATROLMAN**

### **Prevention**

Make scheduled patrol trips in accordance with individual instructions.

Contact specified classes of users.

Give full information to all visitors and users who are met.

Instruct visitors in correct use of fire.

Warn visitors of fire danger.

Post and tear down signs as instructed in individual instructions.

Keep record of users met.

Issue camp fire permits.

Keep daily work and other records required in Fire Plan.

Observe and enforce fire regulations and laws.

Do special jobs as assigned by Ranger.

### **Preparedness**

Carry outfit specified in Forest Plan at all times.

Keep the specified emergency equipment in readiness at all times.

Keep station, tools and equipment in an orderly, usable and clean condition at all times.

Make emergency repairs to telephone lines in case of breaks as specified in Forest Plan or as directed in special orders.

### **Suppression**

Handle all fires encountered.

Handle other fires as defined in Forest Fire Plan or on order of superior.

## **DISPATCHER**

### **Prevention**

Issue camp fire permits.

Issue burning permits when authorized by superior.

Take and record fire weather data, and transmit to protection organization.

Prepare fire news for papers and radio.

Talk to public on fire matters and stimulate interest in Service.

Make annual fire reports and handle other routine fire business on assignment.

Check individual fire reports currently for accuracy, completeness and substandard action.

See that appropriate guards make every effort to obtain evidence for law enforcement action on all actionable fires.

Warn forest users of impending periods of extra danger, as indicated by weather forecasts, etc.

### **Preparedness**

Take part in guard selection and training.

Handle routine reports from protective force.

Keep force stimulated and trained in jobs by daily scheduled contacts over telephone or radio.

Report for prompt action by Ranger any need to replace or arouse men who seem to be letting down.

Keep records showing at all times during fire season of location of all members of Forest force.

Keep similar record of location of permittees or other sources of man power which can be called on in case of fires.

Provide for immediate repair of communication facilities to all key protection points if disrupted during fire season.

Analyze currently all fire conditions and recommend to superiors emergency measures when needed.

Inspect protection men in field on assignment.

Replace tools and equipment as needed by guards. Check for condition and distribution.

### **Suppression**

Receive and record all reports on fires.

Check and determine correct location of fires, obtaining additional lookout readings if needed.

Assign adequate forces promptly to initial attack on all fires.

Re-man key protective points vacated when men sent to fires.



Assign relief dispatcher when fire load is heavy.

Initiate all necessary follow-up action on going fires.

Provide communication facilities in early stages for all large fires.

Calculate probable needs in man power, equipment and supplies (including specialized), anticipate and be prepared to fill orders ahead of probable requests.

Fill promptly all requisitions received for overhead, men, supplies and equipment; keep stocks replenished.

Keep adjacent Forests, districts or agencies from which overhead, men or equipment may be drawn, advised currently of the progress of the suppression efforts; let them know when men or equipment will return.

See to it that forces are reduced as rapidly as conditions warrant.

Check to be sure no fires are left unattended until out.

Advise official superiors currently of situation.

Prepare fire report and round up bills as required.

## **APPENDIX 1**

### **CONDITIONS OF HIRE FOR GUARDS**

#### **Working Hours**

Guards on protective duty will work such hours and days as may be necessary to handle their duties. They can expect to be on duty on Sundays and holidays; wherever practicable, they will be given rest days weekly. When working on other jobs, eight hours a day for five and one-half days a week is considered a week's work.

#### **Standby**

Guards must not leave their stations, except in cases of grave emergency, without permission of their immediate superior.

#### **Saturday Half-Holidays**

Because of the nature of the job, guards ordinarily cannot be relieved from duty on Saturday afternoons. They will be entitled only to compensatory time for Saturday afternoons worked when they can be spared for some other half-day of the ensuing week. This time cannot accumulate.

#### **Work Other Than Fire Control**

In addition to the duties of maintenance of his station, additional jobs of improvement or other work may be assigned to the guard for periods which will not interfere with the major work for which the guard is hired. This will be shown on the guard job list.

#### **Subsistence**

Unless otherwise provided, each guard will subsist himself. Where Government messes other than fire camps are run, payroll deduction equal

to the food costs will be made from the guard's pay.

### **Travel Expenses and Mileage**

Where necessary for guards to be in the field on official business for long periods or to use private cars for official travel, orders for a per diem and mileage will be issued. Reimbursement for such expenses will be made in accordance with the Travel Regulations.

### **Special Equipment**

Guards may be required to furnish a car, motorcycle, or pack and saddle animals. Such requirements are agreed upon at the time of hiring. Where animals are furnished, forage is supplied by the Government.

### **Quarters**

Ordinarily guards will be furnished official quarters. Some furniture and kitchen equipment is frequently furnished. Deductions will be made for quarters furnished at rates ranging from \$20.00 a month to \$5.00 for men in crew barracks. Formal notice is issued in all cases of such deductions. Where guards live in official buildings during the off season of employment, special permits for such occupancy will be issued.

### **Annual Leave**

Guards will be entitled to two and one-sixth days of annual leave for each month worked. This will be given either as it is earned, if the men can be spared, or at the end of the period of employment.

### **Badges**

All guards will wear the regular guard badge at all times when on official duty. This will be pinned to the left breast of the shirt, either just above or through the upper part of the pocket.

Guards who had been on duty at least seven seasons by 1930 are authorized to wear the regular Forest Service badge, at the option of the Forest Supervisor.

Great care must be used that badges are not lost and do not get into the hands of outsiders.

### **Uniforms**

Guards will wear the standard uniform provided for that grade. It will be worn at all times when on official duty except when doing rough work, such as fire fighting, when suitable rough work clothes may be worn. Suppression foreman assigned to handle C. C. C. crews will wear the E. C. Facilitating Personnel uniform unless they already have a regular guard uniform or have a definite promise of transfer into the regular protective force at a fairly early date; in which event they can wear the guard uniform. Specifications on the uniform and where to secure it will be given to the guard by his Ranger.



## **Smoking**

As an example to Forest visitors and users, guards will smoke during the closed period within the National Forests only at places of habitation, in improved camp grounds, in posted smoking places, or at other locations where smoking is permitted. Smoking will not be done on hazardous State highways or county roads, even where no prohibitory ordinances are in effect.

## **Fuel**

The Service has no general responsibility to provide fuel to guards although it supplies stoves. In isolated areas where fuel is scarce it may be good business to pack in gas, such as Flamo, with official pack stock, with the understanding that the man will pay for this gas on a payroll deduction. Where wood is available locally, guards should secure this themselves or pay for hauling it.

Lookouts, as a usual thing, will be furnished oil or gas for cooking at official expense. Where local wood supplies are not readily available for the man to work up himself, fuel will be furnished.

## **Medical Examination**

All lookouts must pass a medical examination and eye test before they will be assigned to duty. Medical examinations must be taken at least every two years thereafter by such men.

Other guards will be required to pass a medical examination wherever there is any doubt as to their physical fitness for the position for which they are being considered.

# **APPENDIX 2**

## **CONDENSED GLOSSARY OF FIRE CONTROL TERMS**

**Alidade**—A straight-edge rule with two vertical sights, mounted to revolve on the central point of the azimuth circle or protractor, and sometimes used at lookout points to measure the direction of fires. (A part of certain types of fire finders.)

**Anemometer**—An instrument used to measure the velocity of wind.

**Azimuth**—The angle, measured from the north in a clockwise direction, which any line makes with the true north and south line.

**Azimuth circle**—A circle graduated in degrees in a clockwise direction from the true north. (Graduated circle of protractor.)

**Back Azimuth**—Azimuth plus  $180^{\circ}$  when azimuth is  $180^{\circ}$  or less. Azimuth minus  $180^{\circ}$  when azimuth is more than  $180^{\circ}$ .

**Backfire**—A fire started intentionally from a prepared line or other barrier, to burn inflammable material in the path of an advancing fire and thus to stop or control it.

**Beaufort scale**—A scale used to denote and estimate wind velocities. (See Appendix 16.)

**Berm**—Outside or downhill shoulder of ditch or trench.

**Blind area**—An area on which the ground or its vegetative cover cannot be seen from any lookout point.

**Boss, camp**—The man in charge of camp activities (feeding, tools, supplies, transportation, etc.), in a fire camp.

**Boss, crew**—The man in charge of a small unit of men engaged in specific work.

**Boss, division sector, etc.**—A man in charge of specific portions of the fire perimeter.

**Boss, fire**—The man in charge of all activities on a fire.

**Camp, spike or side**—A camp, usually small, to accommodate a crew working on an isolated section of the fire, and receiving supplies, etc., from a larger camp.

**Class C fire**—Final area 10 acres or more.

**Clean burning**—Burning out unconsumed scallops, strips, or pockets between control line and fire edge.

**Cold trailing**—Working on the edge of a smoldering fire; usually involving a trail cleared to mineral earth, and disposal of singed, charred, and smoldering material.

**Control time**—See Elapsed time.

**Corralling**—Stopping the spread of a fire by means of made or natural barriers.

**Corral time**—See Elapsed time.

**Direct method**—Applying attack at or near edge of fire. Opposed to indirect, which means working at some distance from edge of fire and backfiring.

**Discovery time**—See Elapsed time.

**Division**—A group of two or more sectors on a large fire. Size of division should be no larger than the division boss can intensively supervise and inspect at least twice each shift.

**Duff**—The decomposed and partly decomposed vegetable matter on the forest floor. (Humus.)

**Elapsed time**—The difference in time between the start of a specified activity and the completion of it.

**DISCOVERY TIME**—Time from start of fire until discovered by lookout or other reporting or controlling agent.

**REPORT TIME**—Time from first discovery until first man charged with suppression action is notified.



- GET-AWAY TIME**—Time from receipt of report by first man charged with suppression action until his departure for the fire.
- TRAVEL TIME**—Time from departure to fire until arrival.
- ATTACK TIME**—Time from arrival at fire until first work.
- CORRAL TIME**—Time from arrival of first man until spread stopped by lines or natural barriers.
- CONTROL TIME**—Time from arrival of first man until line completely mopped up to point of safety.
- PATROL TIME**—Time from control until fire is out or abandoned.
- Elapsed time standards**—Definite maximum allowable periods of time set for various steps of control job.
- Emergency guard**—Men placed on duty in addition to regular protection force during periods of exceptional fire danger.
- Emergency lookout**—Station (or occupant) used only during periods of unusual danger or impaired visibility. Man often functions as a look-out-fireman.
- Emergency ration**—Food assembled in advance ready for immediate transportation and use. The usual one-man one-day ration is assembled in a bag or can container.
- False alarm**—Report of a fire (a) which is a legitimate smoke and requires no actual suppression action; *e. g.*, donkey engine or (b) which does not exist; *e. g.*, dust cloud.
- Feeling for fire**—Feeling with bare hands the edge of a burn to determine whether ground fire still exists. (Feeling out, fingering.)
- Fingering**—See above.
- Fingers of a fire**—Long, narrow tongues of burning area projecting out from main perimeter of fire.
- Fire atlas**—The repository of fire maps, charts and other records used as a basis for fire control planning.
- Firebreak**—A barrier constructed before a fire starts, designed to be used as a control line if fire occurs.
- Fire control**—The entire group of activities having to do with fire studies, organization, prevention, preparedness and suppression.
- Fire finder**—Instrument used at lookout points to determine direction to fires.
- Fire guard**—A general term denoting any member of the fire control organization subordinate to the District Ranger and hired during the fire season for prevention, discovery and suppression of fires.
- Fire line**—A trail, trench, or other cleared strip prepared during progress of a fire, designed to act as the line to obtain control.

- Fireman**—A guard whose principal function is suppression. He generally stays at a fixed point awaiting dispatch.
- Fireman's report**—Brief individual fire report used by a fireman to report data on fires suppressed. (Form 592.)
- Fire flank**—The side of a fire between point of greatest rate of spread and the rear.
- Flanking**—Action of the fire in sweeping around end of a partially completed control line.
- Follow-up**—Additional man power, equipment and supplies sent to aid in suppressing a fire.
- Front of fire**—That part of the edge of the fire with greatest rate of spread. (Head of fire.)
- Get-away time**—See Elapsed time.
- Guard**—See Fire guard.
- Guard, per diem**—A guard working at a daily rather than a monthly rate, and working only intermittently as required (a) by a fire in a particular territory for which he is responsible, (b) as relief for a regular guard, or (c) in emergency fire periods, such as lightning storms, in which case he is also called an emergency guard.
- Gutter**—A ditch dug on a slope below a fire designed to catch rolling material. (Trench.)
- Hazard**—Amount, character and condition of fuels constituting a part of the fire danger.
- Head of a fire**—Front of fire, that is, point of most rapid spread.
- Held line**—Fire line which constitutes the final control line of the fire or portion thereof.
- Hot spot**—A particularly active part of the fire's edge.
- Hot spotting**—Corralling hot spots in advance of building continuous control line.
- Humus**—See Duff.
- Incendiary**—A person who wilfully and maliciously sets a fire to destroy forest cover or other property.
- Indirect method**—Control by using a line well in advance of main fire, and backfiring.
- Inception hazard**—The combined effect of those factors affecting ignition as modified by the degree of risk.
- Individual fire report**—A statement on a prescribed form giving all data on a single fire. (See Forms 929A, 929B-C, 592.)
- Legitimate smoke**—Smokes resulting from industrial operations, ranches, etc., and which are not from forest fires.



- Litter**—Often used in place of “duff” but may include undecayed branches, twigs, cones, etc., not properly classed as duff.
- Lookout**—An observation station used for the discovery and location of fires. Also the guard (lookout man) who occupies such a station.
- Lookout-fireman**—A guard who occupies a lookout station but who is also dispatched to fires.
- Mopping up (Mop-up)**—The acts of making a fire safe after it is corralled, such as extinguishing or removing burning material along or near the line, felling snags, etc.
- Non-reportable fire**—Fire for which no formal statistical record is required. (See Form 929 for current definition.)
- Patrolman**—(a) A moving guard whose principal function is prevention and suppression, or detection and suppression. (b) A member of the suppression force whose duty is to watch and hold a controlled section of the fire line.
- Patrol time**—See Elapsed time.
- Per diem guard**—See Guard, per diem.
- Perimeter of fire**—(a) The entire outer line or edge of the fire, (b) the length of the outer line or edge of the fire.
- Photographs, panoramic**—Pictures taken of the territory seen from the lookout, mounted and used in locating fires.
- Preparedness**—Acts necessary in organization, training, maintenance, equipment, etc., to insure effective work in fire suppression.
- Prevention**—Acts designed to reduce the number of fires through law enforcement, education, control of risks, abatement of hazards, etc.
- Primary lookout**—A lookout station (or occupant) from which continuous detection service is provided.
- Project fire**—A fire of such size and complexity that it requires a considerable staff organization.
- Psychrometer**—An instrument for determining at any particular moment the relative humidity of the atmosphere.
- Reportable fire**—A fire upon which statistical information is required. (See Form 929.)
- Relative humidity**—The percentage of moisture in the air with reference to its total moisture-holding capacity at the given temperature.
- Resistance to control**—For a specified type, is the rate in chains per man hour that held line can be constructed, assuming normal efficiency of labor, sound tactics and most productive use of available equipment and machinery.
- Risk**—(a) The relative probability of fires starting, as determined by the presence or absence of causative agencies. (b) A causative agency.

**Run of a fire**—Usually applied to a period of a fire's history when spread was rapid and frontal attack impossible.

**Sector**—A logical or natural length of the fire line handled as a unit for suppression purposes. Normally a sector should not exceed the amount of line the man in charge (sector boss) can completely supervise and inspect at least four times each shift.

**Scout**—A man who works ahead of main suppression forces on a fire, to ascertain and report on spread, problems to be encountered, best means of reaching and attacking, etc.

**Scouting**—Act of looking over a fire or portion thereof, determining rate of spread, dangers ahead, etc.

**Secondary lookout**—A station (or occupant) whose detection function is interrupted when necessary for suppression or other fire control duties. (See lookout-fireman.) Used also to refer to emergency lookout points.

**Seen area**—Area so located in respect to lookouts that it or its vegetative cover can be seen directly during normal conditions. (Visible area.)

**Slash**—Debris resulting from timber or brush cutting.

**Snags**—Standing dead trees or parts of trees.

**Spot fires**—Fires set in advance of or away from the main fire by flying embers.

**Sprout**—A rapidly spreading offshoot from the side or rear of the main fire.

**Suppression**—All the work of extinguishing a fire, beginning with discovery.

**Travel time**—See Elapsed time.

**Trench**—A ditch dug or constructed along a slope below a fire, designed to catch rolling material.

**Translation hazard**—Combined effect of those factors affecting rate of spread, such as wind, fuel, moisture, and topography.

**Unseen area**—See Blind area.

**Visibility**—Degree of clearness of vision from lookouts, depending upon atmospheric conditions.

**Visible area**—See Seen area.

**Visible area map**—Map showing area visible from lookouts.

**Warden, fire**—Usually applied to an officer bearing a State commission to enforce State fire laws.

**Zone**—A group of several divisions on a very large fire under the supervision of a zone boss, where, because of the size and inaccessibility of the fire its sides must be handled almost as separate fires, except for co-ordination of general strategy.



# APPENDIX 3

## RECONDITIONING FIRE TOOLS

### REHANDLING OF FIRE TOOLS

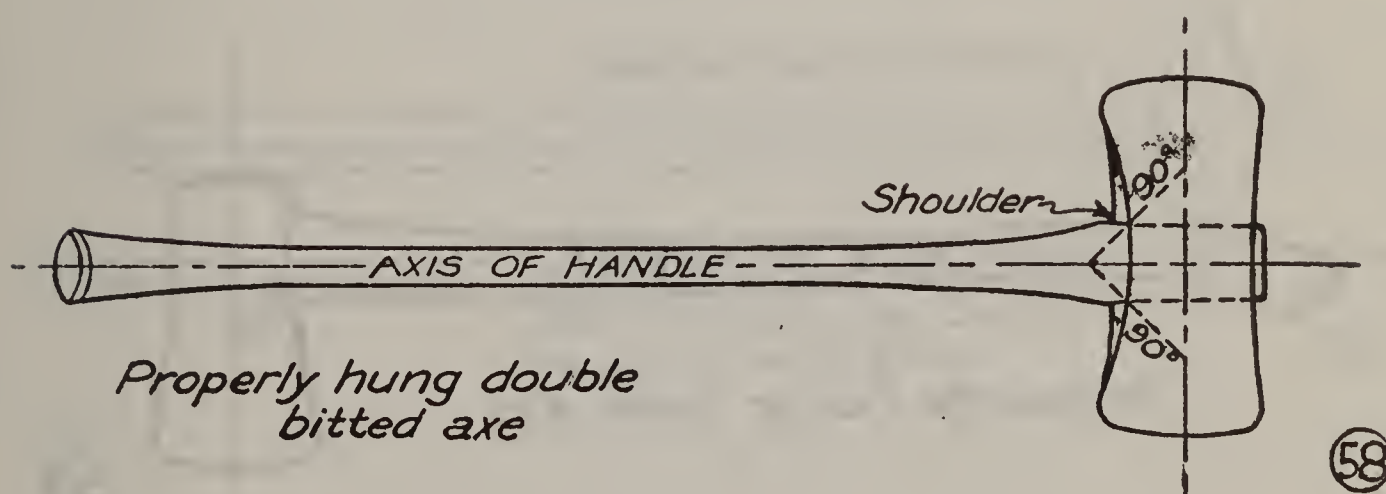
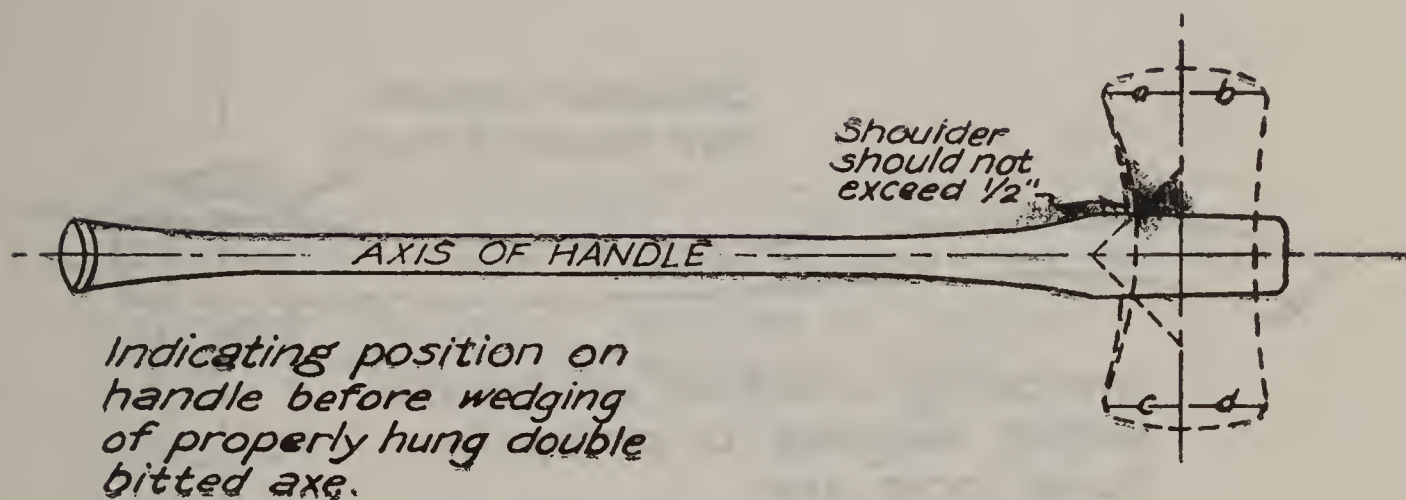
#### Axes, Sledges, Pulaski, Brush Hooks

1. A correctly inserted handle has its axis at right angles to the axis of the block. Sketches that follow illustrate a properly hung axe and sledge. Method of lining up the axis of the handle with that of the blade to fit the marks indicated at "a" and "b" will aid in gauging the alignment of the head and handle.
2. Fit the handle as tightly as possible by driving it into the eye of the head to within one-half inch of its shoulder.
3. Drive a thin wood chisel ( $\frac{1}{2}$ " to  $\frac{3}{4}$ ") into the handle as far as possible without spreading the eye, and repeat the operation until the end of the handle, along the center parallel to the long axis of the eye, is split.
4. Drive one or two thin white or Douglas fir wooden wedges into this split.
5. With a saw, trim the end of the axe handle protruding through the eye, even with the eye; for a sledge, trim off to within  $\frac{1}{2}$  inch of head.
6. Drive two iron wedges at a 45 degree angle to the wooden wedges, as shown in sketch, being careful not to spread the eye of such tools as the axe, Pulaski, brush hook, etc.
7. A tight handle can be driven out easily if first there are a series of holes bored into the end. Never heat the head to loosen the handle.

#### Mattocks and Like Tools

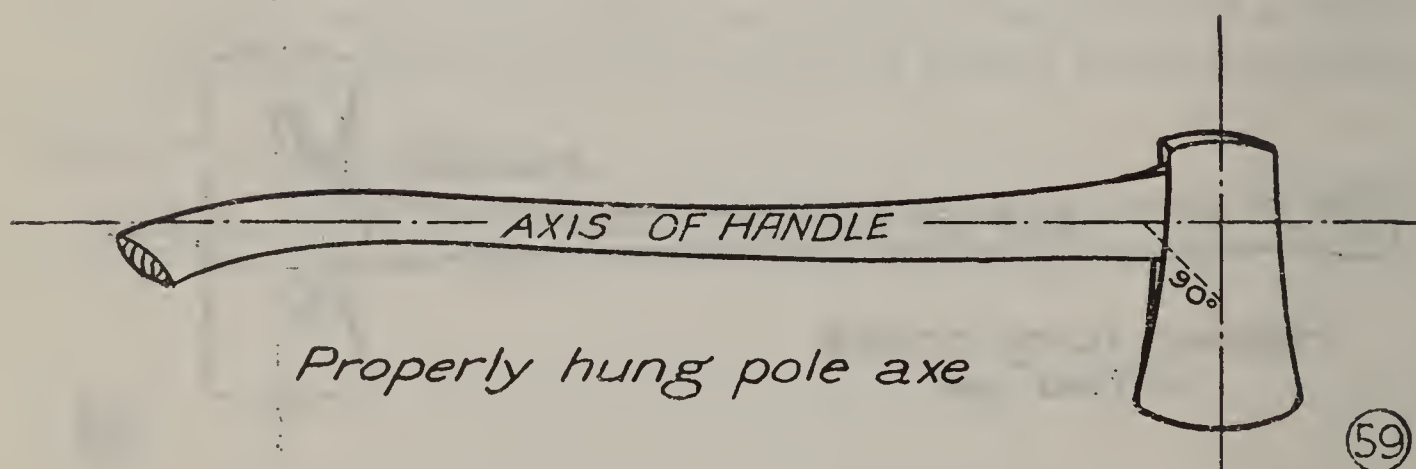
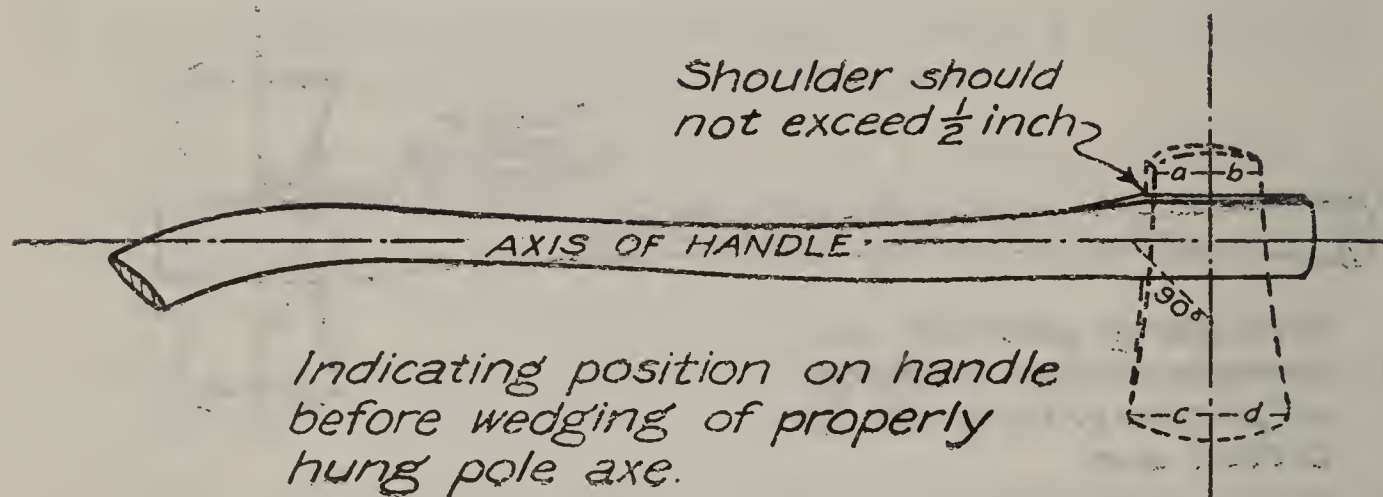
Mattocks and all other tools which have the largest section of eye forward should be well fitted to the extreme end of the handle.

## PRINCIPLES TO BE OBSERVED IN HANDLING AXES



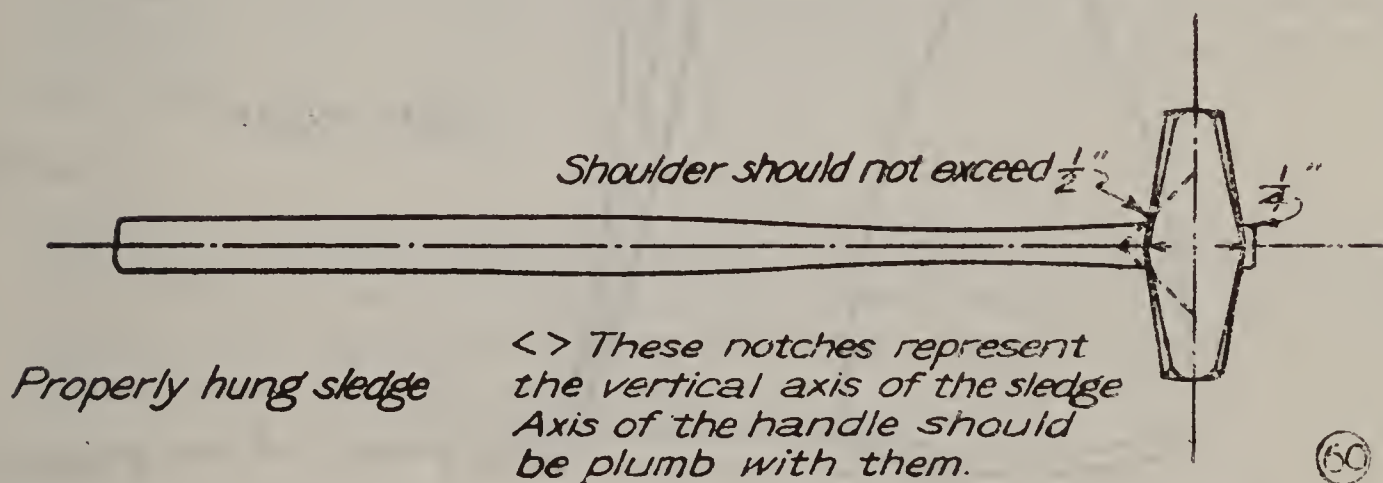
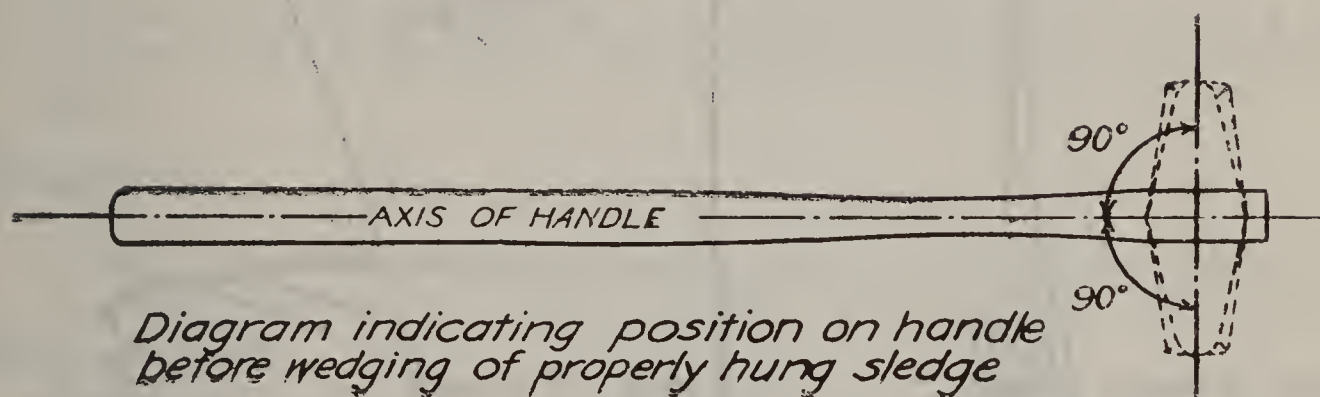


## PRINCIPLES TO BE OBSERVED IN HANDLING AXES



(59)

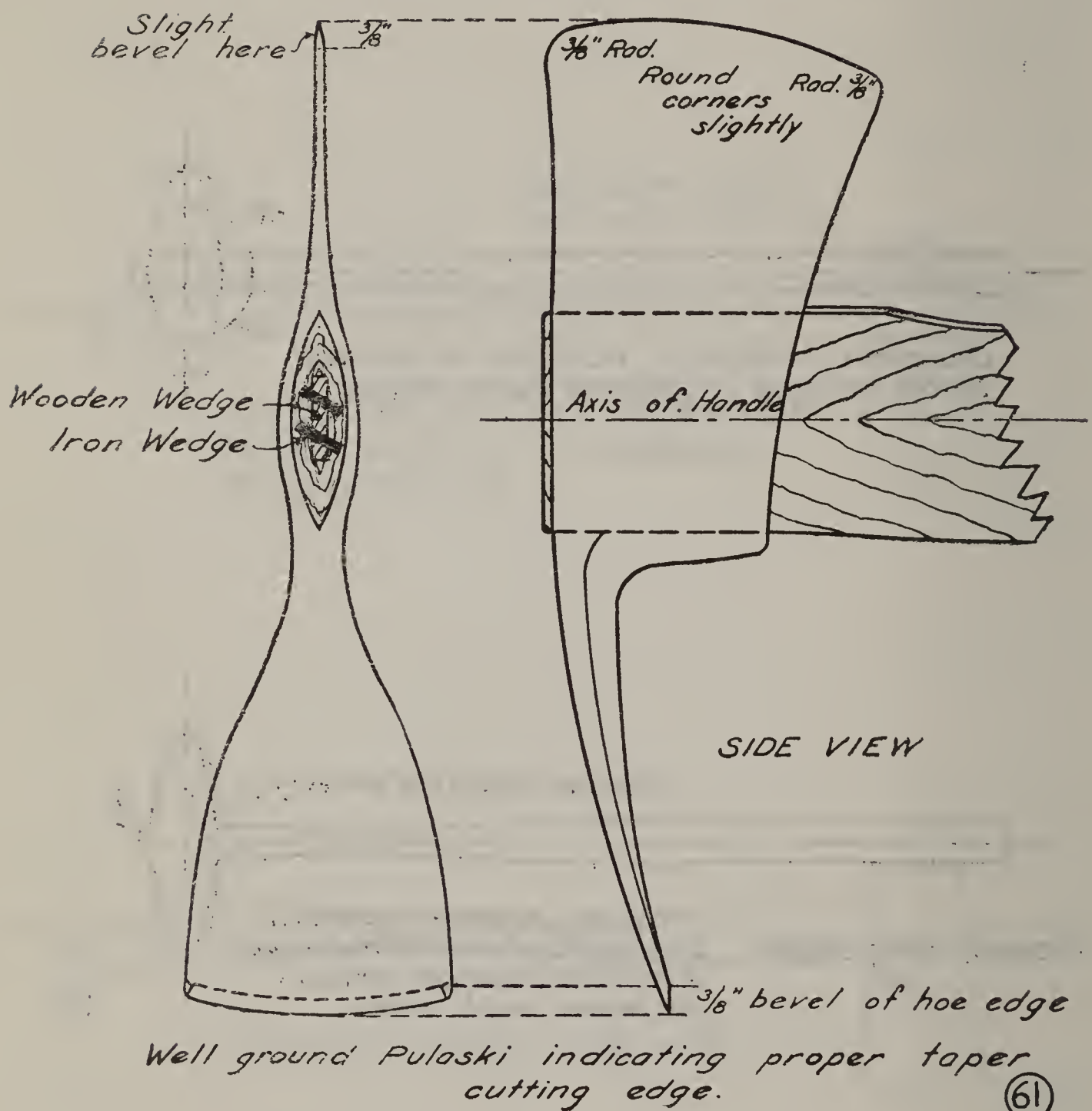
# PRINCIPLES TO BE OBSERVED IN HANDLING SLEDGES



(50)



## REHANDLING PULASKI TOOL



## GRINDING FIRE TOOLS

### **Axe, Double Bit**

Grind both sides in an even taper back from the cutting edge at least  $2\frac{1}{2}$  inches. See sketch.

### **Axe, Boys' (Pole Axe)**

Grind in an even taper back from the cutting edge at least  $1\frac{3}{4}$  inches.

### **Brush Hook**

Grind both sides of the long portion of the cutting edge in an even bevel back from the cutting edge at least 1 inch. Care must be taken with the throat to keep its circular pattern. Carefully grind throat back 1 inch on an even bevel. Grind hock or point back on a bevel approximately  $\frac{3}{4}$  inch.

### **Hazel Hoe**

Grind to a good cutting edge. The bevel to be approximately  $\frac{3}{8}$  inch deep on the inside of the blade, that is, side facing the handle. See sketch.

### **McLeod Tool**

Grind the hoe so there is a good cutting edge on the inside face; bevel to slope outward at an angle of approximately 45 degrees. Bevel to be on outside of blade away from handle. See sketch.

### **Mattock**

Grind on both bits to a good cutting edge. Bevel off the mattock bit to be approximately  $\frac{1}{2}$  inch to  $\frac{5}{8}$  inch deep; grind on the inside (the side facing the handle). Bevel on the cutter to be  $\frac{3}{8}$  inch to  $\frac{1}{2}$  inch deep, ground on both sides.

### **Pulaski**

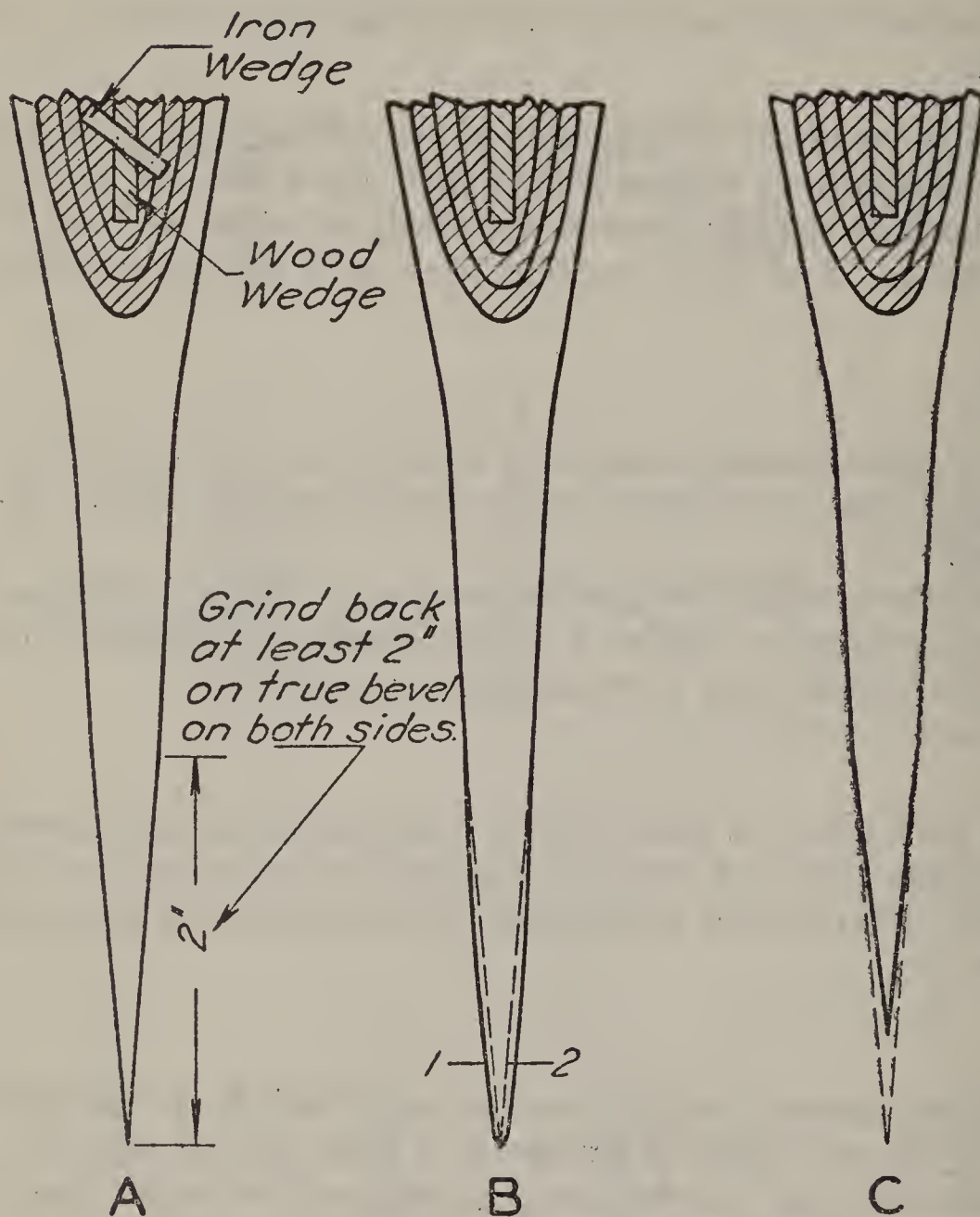
Axe bit to be ground sharp in an even taper back from the cutting edge at least  $2\frac{1}{2}$  inches. Hoe side ground to a good cutting edge, the bevel to be approximately  $\frac{3}{8}$  inch deep on the inside of the blade; that is, on the side facing the handle. See sketch.

### **Shovel**

Each edge of the shovel is sharpened from the point to approximately  $3\frac{1}{2}$  inches from the top of the blade, the bevel being on the top face of the blade. See sketch 65, page 137.



## PRINCIPLES TO BE OBSERVED IN SHARPENING AXES



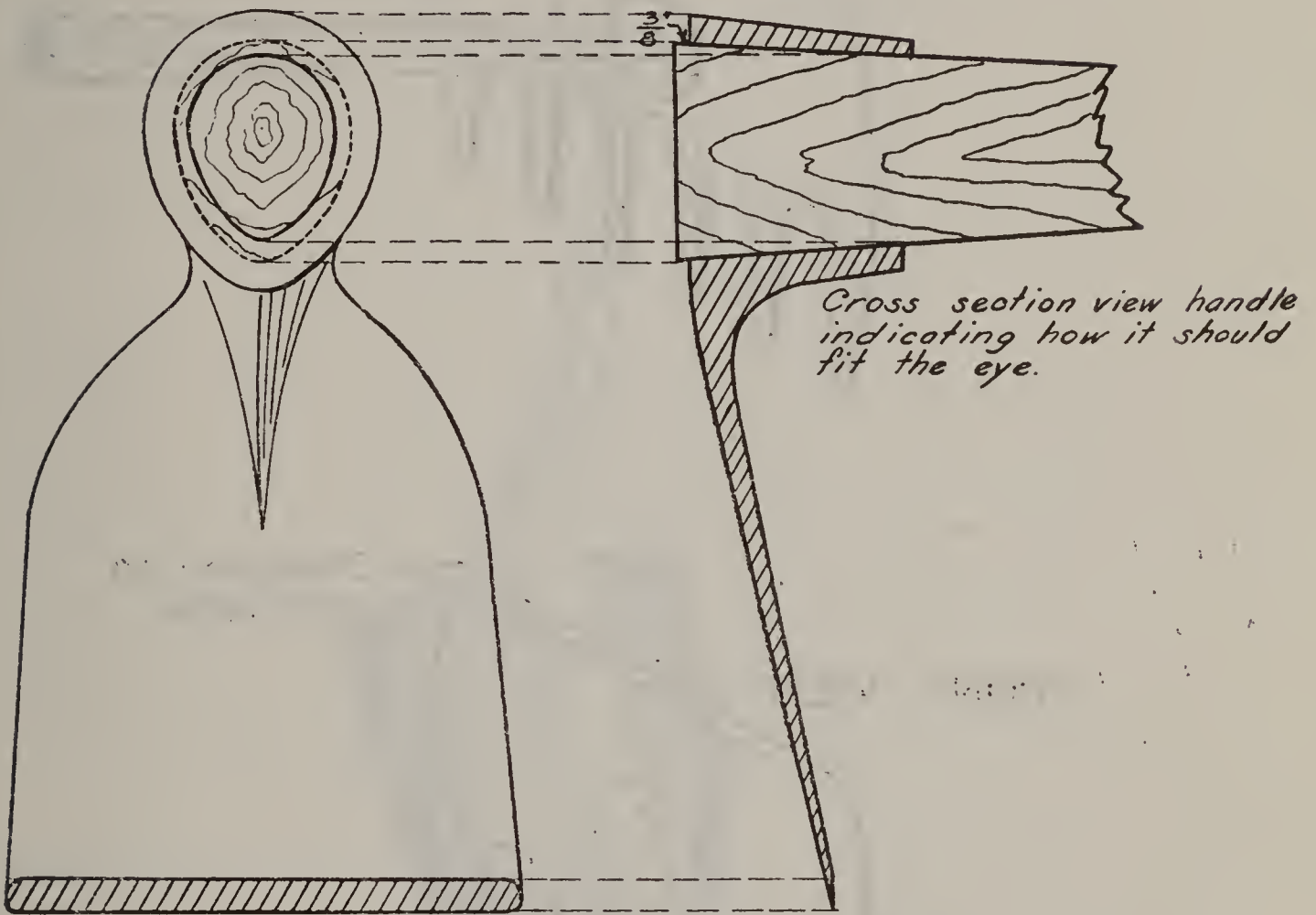
(62)

- A - Well ground axe indicating proper taper to cutting edge.
- B - Improperly ground axe. Shoulders at (1) and (2) should be reduced so axe appears as indicated by dotted lines.
- C - Frequent grinding will shorten blade but proper cutting edge should be preserved as indicated.

## SHARPENING HAZEL HOE

REAR VIEW

SECTIONAL VIEW



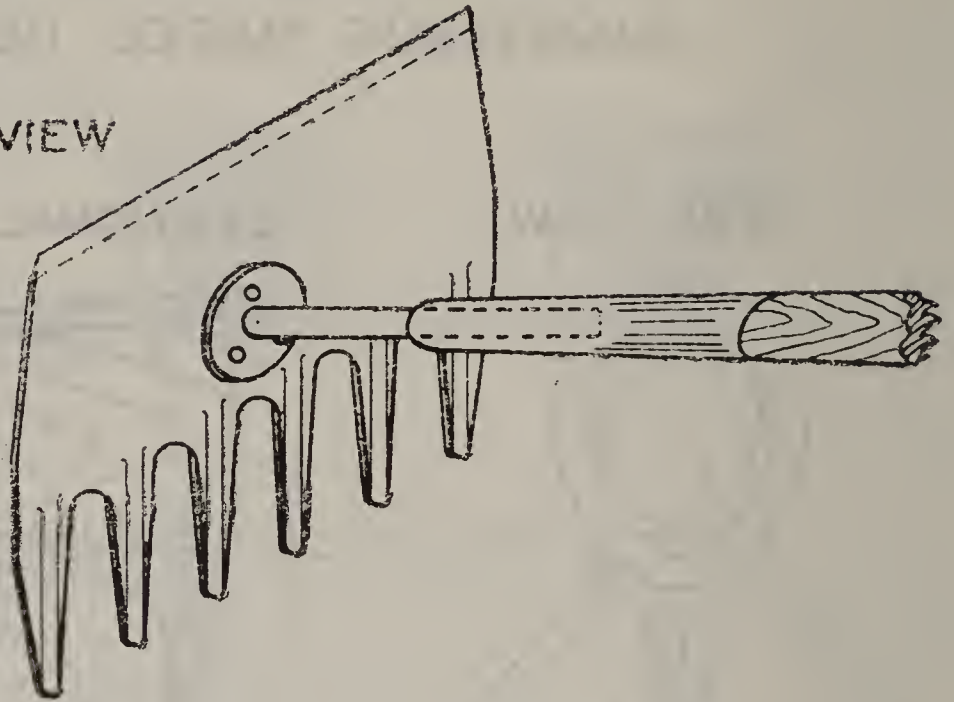
*Well ground Hoe indicating proper taper to cutting edge.*

63

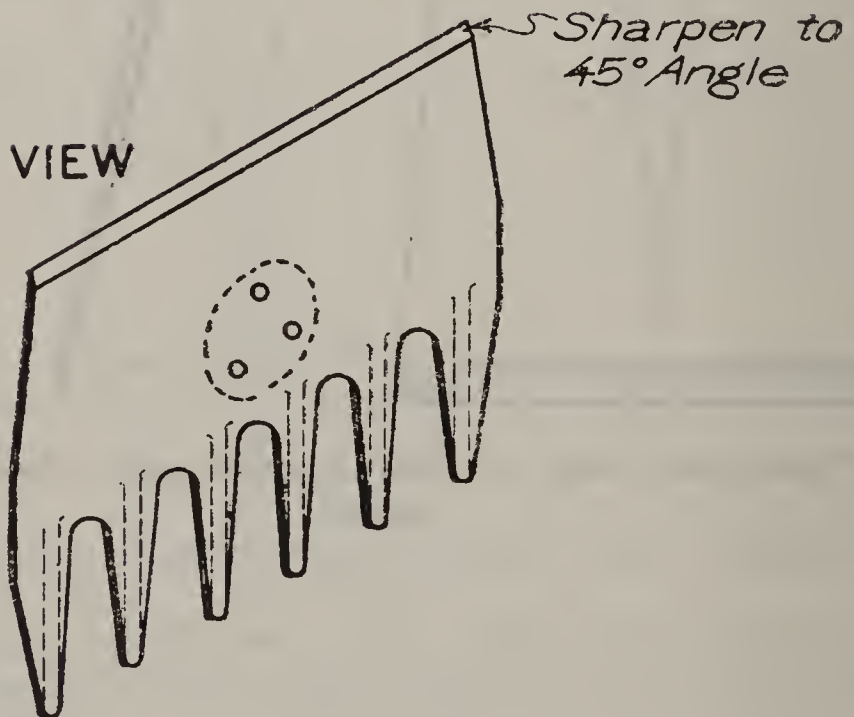


## GRINDING OF McLEOD TOOL

REAR VIEW



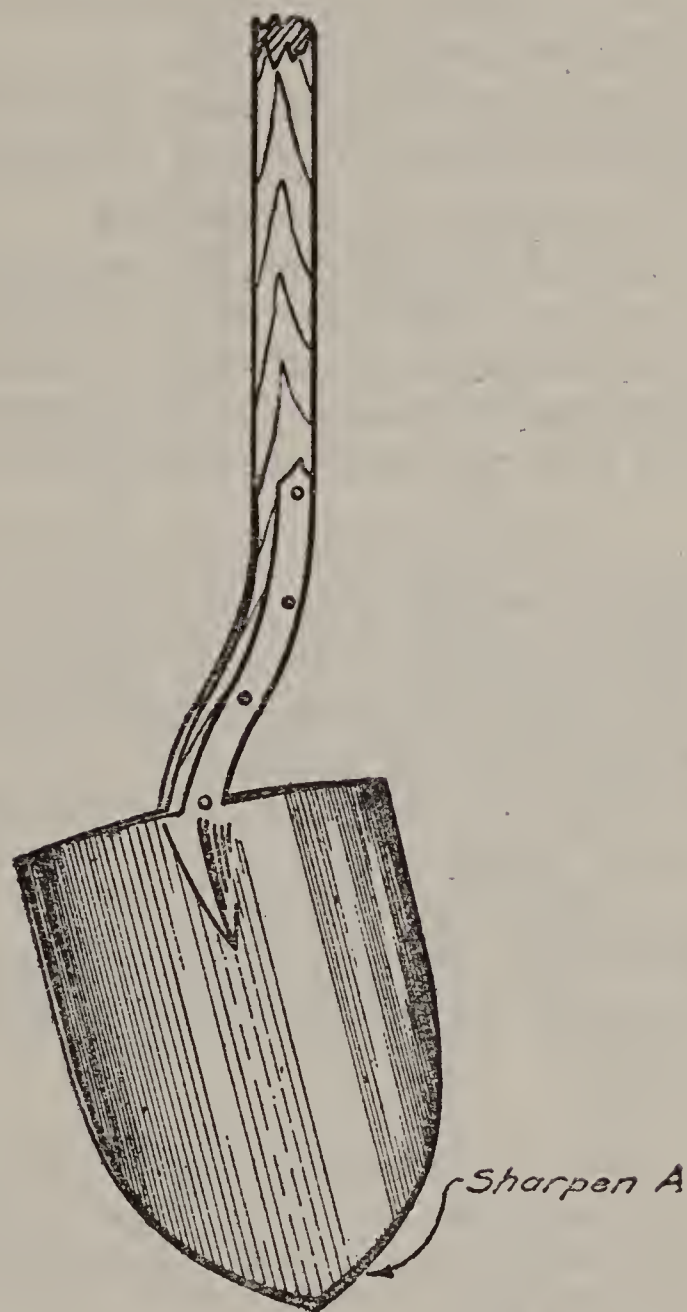
FRONT VIEW



*Well ground McLeod tool indicating proper taper to scraping edge*

64

## GRINDING SHOVEL



*Well ground shovel indicating  
proper taper to digging edge. 65*



## RUST PREVENTION

### Mess Kits

Treat before storing with liquid petroleum to prevent rust. To apply, saturate thoroughly a soft rag or sponge with the oil, wring as dry as possible and go over each article, being sure to cover every part.

### Axes, Shovels, Pulaski and Like Tools

Oronite priming solution or comparable material will be applied to metal parts of fire tools, such as axes, shovels, etc., to prevent rust during extended periods of non-use. This may be done with a small brush, being careful to apply only a light coating.

## MARKING FIRE TOOLS AND EQUIPMENT

In order to prevent loss from theft and as a means of ready identification, all fire tools and equipment must be marked.

As a permanent mark of identification, all metal parts of fire tools will be stamped "F.S." and the handles branded "U.S.F.S." Sufficient of the wooden portion of the handle to permit ready identification will be given a coat of red paint, but not in excess of a distance of 4 inches above the point where the wood joins the metal. Red paint is to be used only on fire equipment.

Water bags, buckets, canteens, beds, tents and all other similar equipment are to be stenciled U.S.F.S. in letters at least one inch high, or marked with the regulation shield, preferably the latter.

The F.S. die will be stamped at a specified place on the blade or head of each tool. The following system is standard:

Shovels. Stamp on right-hand corner on inside when in position for use.

Pole axes. Right side, middle of eye.

Double bitted axes. Either side, middle of eye.

One-man saw. Right-hand side close to handle near top.

Crosscut or felling, two-man saw. Either side or end.

Mattock. Either side.

Hoe. Right-hand side.

In stamping fire tools not listed above, place the brand on the upper right-hand side of the tool when it is in its proper position for use.

The U.S.F.S. brand will be placed on the handle of all fire tools, as follows, when in position for use:

|                      |   |
|----------------------|---|
| Pole axe             | Right side of handle, against head.                         |
| Axe, double bit      | Either side of handle, against head.                        |
| Shovel               | Right side of handle, against blade.                        |
| McLeod               | Right side of handle, against blade, assuming use as a hoe. |
| Saw handle, crosscut | Right side of handle, opposite center bolt.                 |
| One-man saw          | Right side of handle.                                       |
| Pulaski              | Right side of handle, against head, assuming use as an axe. |

|                  |                                       |
|------------------|---------------------------------------|
| Hazel hoe handle | Either side of handle, against blade. |
| Mattock          | Either side of handle, against head.  |
| Rake             | Right side of handle, against head.   |
| Sledge           | Either side of handle, against head.  |
| Brush hook       | Right side of handle, against head.   |

## REPAIRING FIRE TOOLS AND EQUIPMENT

### Gasoline Lantern

The most common troubles and remedies are:

|                       |   |
|-----------------------|---|
| Dirty gasoline        | Remove dirt from container. Refill with clean white gasoline. |
| Plugged generator tip | Replace or clean with fine wire.                              |
| Broken mantle         | Replace.  |
| Pump will not work    | Replace gasket.   |
| Leaky filler cap      | Replace gasket.   |
| Broken check valve    | Replace valve.  |
| Bowl broken at seams  | Discard. Do not try to solder.                                |
| Leaky generator valve | Replace.  |

### *Precautions to observe in use of gasoline lantern*

Fill bowl only about  $\frac{3}{4}$  full to allow space for pumping up.

Turn on gas only after the lantern has started to generate.

Discard until repaired any lanterns with leaky bowls, valves or joints.

Fill lantern outdoors, preferably using small funnel to avoid spilling gasoline. Never fill around open flame. Use flashlight for light when filling at night.

Wipe off carefully after filling before lighting.

Never replace the filler plug by a cork or home-made plug.

Leave top of lantern and shade on when in use.

Place or hang sufficiently far from walls or ceiling to prevent starting fires.

Use only white high test gasoline.

### Electric Headlamp

Following are the main points to check when electric headlamp does not work:

If, after progressively trying a new bulb, fresh batteries, checking all connections, and increasing the tension of spring in rear cap, the headlamp does not work, two things remain to be checked—the cord for breaks, and the switch. The cord can be checked by using a telephone battery. Test each individual wire in the cord by placing one cord on the positive pole and touching the negative pole with the other wire. If sparks result, strand is not broken. If the other strand gives a positive spark, cord is not broken.



If the headlamp does not work after these tests, the switch is defective. Repair by replacing barrel.

### **Backpack Pump**

In reconditioning a backpack pump, the following points should be checked.

If container leaks, and this is due to minute holes or seams slightly sprung, remedy by soldering.

Hose connections should be tightened; if the hose leaks, replace with new hose, being sure to use hose cement when replacing.

The plunger washer is usually at fault if the pump will not work. Replace with new washer.

Sometimes the pump works too hard, which may be due to three causes: (a) the plunger barrel may be gummed up, which can be remedied by cleaning with coal oil; (b) the packing gland nut may be screwed up too tight, which can be corrected by loosening. Should this cause the pump to leak, repack pump; (c) barrel or plunger may be badly bent. Pump must be discarded.

A leaky pump can be fixed by removing the packing gland washer and repacking.

A plugged nozzle is generally due to some foreign substance getting into the jet. Remove nozzle and remove foreign substance with small wire.

A nozzle leaking around the joint may be remedied by replacing the washer at the joint.

## **APPENDIX 4**

### **CARE OF FIRE HOSE**

Drain hose on special racks or towers.

Wash jacket and dry thoroughly, avoiding exposure to hot sun as much as possible. Scrub with stiff brush and lots of clean water to remove mud and dirt.

Store during fire season in coolest, driest place available with plenty of free air circulation. Coil only sufficiently to prevent telescoping when handled. Tie coil only with rope, binder twine or tape.

In winter, store uncoiled in cool, dry place with good air circulation.

Test all hose before fire season, and at least once a month during season. Discard any lengths failing to withstand 250 pounds pressure.

## APPENDIX 5

### TELEPHONE TROUBLE SHOOTING AND EMERGENCY REPAIRS

**Problem 1: Telephone bell does not ring or rings very faintly when others call.**

*What to look for:*

1. Line wire, drop wire, or lead-in wire may be broken.
2. Short circuit in lightning protection. Disconnect protection from rest of circuit or pull out protector tube.
3. Line wire may be grounded by resting on ground.
4. Broken wire or connection in telephone set.

**Problem 2: Bell rings frequently without apparent cause.**

*What to look for:*

1. Wiring cross with some other telephone line.

**Problem 3: Bells at switching station will ring when calling on only one line.**

*What to look for:*

1. If all bells ring, even when switches are open and no cross exists between lines, (a) there may be a poor ground, (b) too high resistance of wire leading from ground due to wire of too small gauge being used.

**Problem 4: Guard cannot ring bells of other telephones.**

*What to look for:*

1. Line wire, drop wire, or lead-in wire broken.
2. Fuse open—replace.
3. Grounded line wire—line wire touching or buried in ground.
4. Short circuited protector blocks. Disconnect protector unit and wire around it.
5. Poor ground (ground rod not thoroughly rooted).
6. Broken wire or connection in telephone set. Repair break.

**Problem 5: Guard cannot make others hear him talk.**

*What to look for:*

1. Batteries weak or incorrectly connected.
2. Switch hook out of adjustment or contacts are poor.
3. Check wiring connections. Clean and tighten.
4. Transmitter is packed. Rap sharply with knuckles on side of transmitter.



5. Receiver or receiver cord broken. Connect one end of receiver cord to battery and click should be heard when other end is touched to opposite part. If click is heard, cord is also okay.

**Problem 6: Guard cannot hear others talk.**

*What to look for:*

1. Defective or dirty receiver. Remove cap; tighten connections.
2. Receiver open or short circuited. Same test as above.
3. Switch hook out of adjustment. Adjustment of springs necessary but must be carefully made.

**Problem 7: Guard's conversation interrupted so he only hears part of conversation.**

*What to look for:*

1. Loose connection on line or ground wire. Tighten joints.
2. Line wires crossed or grounded intermittently. Separate.
3. Line wires swinging against lightning rod on poles.
4. Receiver cord partly broken. Test with battery. See Problem 5 above. Replace cord with two insulated wires.
5. Loose connections in batteries. Tighten.
6. Unsoldered connections at ground rod. Resolder or use clamp.
7. Bad splice in line wire. Cut out and make standard.

**Problem 8: Generator turns hard.**

*What to look for:*

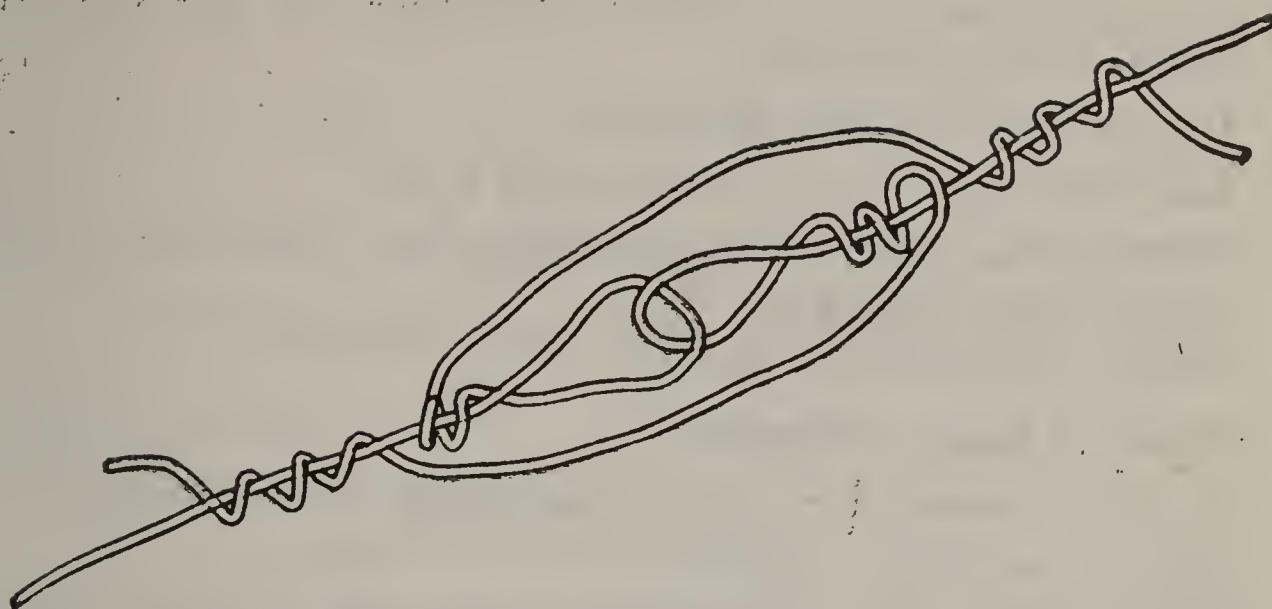
1. Line wire grounded.
2. Protector block grounded. Remove from circuit.
3. Protector shorted by lightning. Remove protector tube.
4. Wires crossed if metallic circuit.
5. Generator needs oil. Don't oil it unless you know how.

**Emergency Line Repairs.**

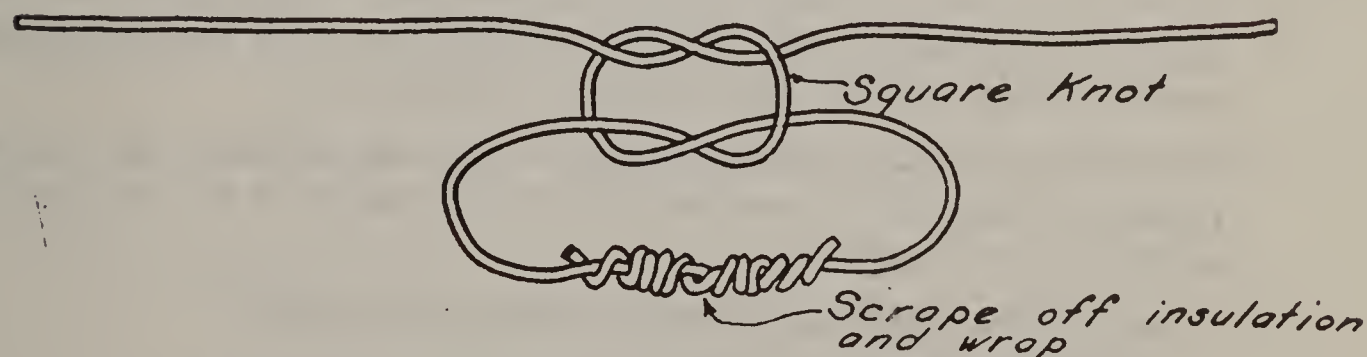
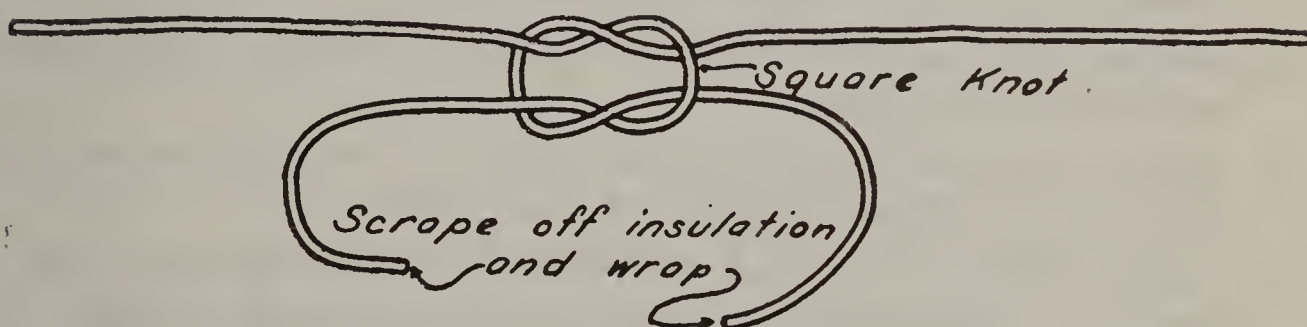
It is sometimes necessary to repair a break in the line wire without tools.

An emergency splice which can be made without tools is shown in sketch and described as follows:

1. Make an "eye" in one end of the wire.
2. Pass the end of the other wire through the eye.
3. Pull up slack.
4. Bend the end back and make a couple of wraps around the line wire.
5. Cross the free ends and wrap them around the line wires as shown.
6. The emergency splice is complete.
7. Leave marker and note to indicate repair to the man who may be coming in from other way to check line.



EMERGENCY MAINLINE SPLICE



STANDARD SPLICE FOR EMERGENCY WIRE.

66



## APPENDIX 6

### CARE AND USE OF SLING PSYCHROMETER

#### Care.

1. Keep clean muslin on wet-bulb thermometer. Do not touch with fingers or let it get dirty.
2. Use clean water to wet the muslin.
3. Use water which is same temperature as air.
4. When drying psychrometer, be clear of guy wires and other objects to avoid breakage.
5. Keep in case when not in use.

#### Use in Obtaining Relative Humidity.

1. Have psychrometer in shade of building or of own body.
2. Moisten muslin thoroughly.
3. Whirl psychrometer, looking at it occasionally, until the wet-bulb thermometer reading will go down no further, and starts to rise.
4. Repeated whirling and readings necessary to determine this point.
5. Record the lowest reading observed.
6. Read dry-bulb thermometer and record it.
7. Subtract the wet-bulb reading and call this figure "Depression of wet-bulb thermometer."
8. Refer to relative humidity table which is furnished for use at the elevation which includes that of your station.
9. Follow down the column marked "air temp" until you find the figure previously written down for the dry-bulb reading. Keep track of this place on the form.
10. Then locate the column under the heading "Description of wet-bulb thermometer" with the figure identical with that previously written down for the depression of wet bulb.
11. The figure in this column, which is directly opposite the air temperature (dry bulb) reading located in step 9, is the relative humidity figure desired.
12. Record and report according to Forest instructions.

Example of use of table:

|                      |       |
|----------------------|-------|
| Elevation of Station | 1800' |
| Dry bulb reading     | 70°   |
| Wet bulb reading     | 59°   |
|                      | <hr/> |
| Depression wet bulb  | 11°   |

# RELATIVE HUMIDITY TABLES

Relative Humidity per cent for elevations up to 2000 feet

| Air temp. | Depression of wet bulb |    |    |    |     |     |      |
|-----------|------------------------|----|----|----|-----|-----|------|
|           | 6°                     | 7° | 8° | 9° | 10° | 11° | etc. |
| 50°       |                        |    |    |    |     |     |      |
| 70°       |                        |    |    |    |     | 52% |      |

52% is relative humidity reading.

## APPENDIX 7

### ADJUSTMENT OF FIRE FINDING DEVICES

#### Osborne Fire Finder

##### 1. *Leveling the fire finder*

- Check leveling each morning.
- Place level tube on machined surface of graduated ring at azimuth reading of about 45°.
- Turn leveling screws until bubble in level tube is exactly centered.
- Repeat 3 times with level placed at first approximately 135°, second at 225° and third at 315°.
- Keep guide lugs on the base below center of bars on track to prevent side play.

Why:

To prevent errors in vertical readings. The slightest variation from level will make vertical angle readings incorrect.

##### 2. *Checking sights and vertical hair for plumbness*

- Check vertical hair in front sight by following steps listed below.
  - Hang weighted thread on string from inside window frame.
  - If hair does not coincide with string, the hair is not straight.
- Adjustment.
  - Loosen screw on sight fastening the horse hair.
  - Pull the horse hair tight.
  - Tighten the screw again.
  - Hair is then tight and straight. If it then does not coincide with string, notify Ranger.
- Replacing cross hair.
  - Have on hand extra supply of dark horse hair (in emer-



- gency black thread or fine wire may be temporarily used).
2. Loose both top and bottom screws holding hair.
3. Thread new hair through bottom holes provided in sight standard.
4. Wrap hair around bottom screw and tighten screw.
5. Thread hair through top hole provided.
6. Pull tight.
7. Wrap around top screw and tighten screw.

(d) Rear sight. Checking rear sight slot to see if vertical.

1. Finder has been leveled.
2. Hair of front sight is plumb.
3. Sight on small dot or point.
4. Raise eye slowly from bottom to top of slot.
5. Report to Ranger if slot is not vertical.

3. *Orienting fire finder* (Check orientation every morning) Start orienting only after instrument is leveled.

- (a) A designated orientation point has been selected by the Ranger and the bearings recorded and posted in the lookout house.
- (b) Loosen screws below plate of finder.
- (c) Set vernier at correct reading of orientation point.
- (d) Revolve, not sights, but entire plate of the instrument until sights are trained on orientation point.
- (e) Tighten screws previously loosened.
- (f) Finder is then oriented.

### **Bosworth Fire Finder**

The Bosworth fire finder is leveled and oriented when it is installed. If an accident should get the instrument out of level, notify the Ranger immediately.

#### **1. *Orienting***

While the fire finder is not likely to get out of orientation, check it each morning by:

- (a) Setting the sights on the azimuth recorded and posted near the instrument.
- (b) Sight on the topographic orientation point.
- (c) If the vertical hair does not intersect the orientation point, the instrument is not properly oriented.

In such case, orient by:

- (a) Loosening the clamp screw beneath the plate (not the one on the pedestal).
- (b) Swing the whole plate (not the sights) until the vertical hair intersects the topographic orientation point.

- (c) Tighten the screw previously loosened.
- (d) The instrument is now oriented.
- (e) Record, and call attention of Ranger to any parts of the map that are found to be out of orientation when the fire finder is oriented with respect to the specified orientation point. He will check the map itself and adjust it for you.
- (f) Take special care to orient the fire finder again after raising or lowering the height of the instrument. Be sure the clamp screw for adjusting height of instrument is tight.

2. *Tightening and straightening or replacing vertical hair*

The methods used for this are identical with that for the Osborne Fire Finder.

## APPENDIX 8

### SUMMARY OF FEDERAL AND STATE FIRE LAWS AND REGULATIONS

#### OFFENSE\*

#### IN VIOLATION OF

#### **Backfiring**

Setting or causing backfires to be set except under supervision or permission of State or Federal officer unless it can be established action was required to save life or valuable property.

Cal. Stats. 1931, Ch. 311.  
Penal Code Sec. 384 (4).  
(Does not apply inside municipalities.)

#### **Blasting**

Between April 15 and December 1.

See Burning permits.

#### **Burning Materials**

Throwing or placing lighted cigarette, cigar, ashes, or other flaming or glowing substance or thing which might cause fire in any place where such substance may directly or indirectly start a fire.

Cal. Stats. 1931, Ch. 311.  
Penal Code Sec. 384 (5).  
(Does not apply inside municipalities.)  
Nevada, Laws of 1929,  
Ch. 134.

#### **Burning Materials, Throwing from Moving Vehicles**

Throwing any lighted tobacco, ashes, or any flaming substance which may cause a fire from moving vehicle.

Cal. Stats. 1931, Ch. 311.  
Penal Code Sec. 384 (6).  
(Does not apply inside municipalities.)  
Nevada, Laws of 1929,  
Ch. 134.

NOTE: \*—All misdemeanors except as noted.



## Burning Permits

Burning inflammable cover, blasting, setting off fireworks either on own land or on another's between April 15 and December 1 without permit issued by State Forester or agent. Burning small piles on rocks, in yards, gardens, etc., 100 feet from any timber, brush, or inflammable cover not forbidden; at least one person must be in attendance.

## Camp Fire Permits

Building a camp fire without Federal permit on designated National Forest areas.

Maintaining or using camp fires on private land not his own without permit from owner or Forest Service permit for adjacent area between May 1 and October 31, north of 38° latitude and west of 122° longitude (other areas April 15-Dec. 1).

## Camp Fires

Leaving a camp fire, started or attended by him, burning or unextinguished without some person in attendance or allowing such fire to spread unless fire is confined in stove, drum, or other non-inflammable container so it cannot escape. Fires in permanent dwellings being occupied are not affected.

Wilfully and negligently leaving fires unextinguished upon departing from a camp or from any fire started in the open.

## Clearing Around Logging Equipment

Using any wood or coal burning steam operated donkey or stationary engine between May 1 and October 31 in any forest or brush-covered land without first clearing away all inflammable material, including snags, with 100-foot radius unless fire prevention measures approved by State Forester are adopted—clearing around loader 25 feet; with rotten wood covered with dirt up to 50 feet.

Cal. Stats. 1931, Ch. 311. Penal Code Sec. 384 (3).

(Redwood logging and municipalities exempted except Reg. T 1 (A) Sec. of Agr. Forest officer can issue permit on National Forest lands.)

Regulation T-1E, Sec. of Agriculture. Cal. Stats. 1929, Ch. 115, Sec. 3. Cal. Stats. 1931, Ch. 311. Penal Code Sec. 384 (1). (Does not apply inside municipalities.)

Cal. Stats. 1931, Ch. 311. Penal Code Sec. 384 (12). (Does not apply inside municipalities.)

Nevada, Revised Laws, 1912, Section 6632.

Cal. Stats. 1931, Ch. 311. Penal Code Sec. 384 (10). Applies in redwood area outside of logging May 1 to October 31 only. (Does not apply to redwood logging or inside municipalities.)

**Closure**

Going or being upon portions of National Forest designated as areas of fire hazard without proper permit.

Reg. T. 1 E. Sec. of Agriculture. (Does not apply to actual settlers going to and from their homes.)

**Conscription of Men**

See Fire Fighters, Conscription.

**Escaping Fires**

Allowing fires to escape to lands of others without exercising due diligence to control.

Cal. Stats. 1931. Penal Code Sec. 384 (2). In redwoods May 1 to Oct. 31, only. (Does not apply inside municipalities.)

**Failing to Extinguish Fires**

Failure to extinguish fire built in or near publicly owned forest, lumber, or other inflammable material before leaving.

Fed. Law Mar. 4, 1909 (36 Stat. 1088). Sec. 53, Criminal Code.

Wilfully or negligently setting or failing to extinguish fire on his own land or that of another endangering others' timber or property.

Nevada, Revised Laws, 1912, Sec. 6579.

**Fire Fighters, Conscription of**

Refusal to obey summons by State Fire Warden of able-bodied males to assist in suppressing fires.

Cal. Stats. 1931. Ch. 788. Sec. 4.

Refusal by able-bodied males, between 16 and 50, to obey summons or assist in fighting fires for not over five days a year.

Nevada Laws of 1927, Chapter 45, Sec. 1.

**Fire Tools, Hose, and Pump on Logging Equipment**

Operating between May 1 and October 31, gasoline, steam, or electric driven donkeys or stationary engines in any woods operation without a box of special fire tools available to outfit ten men, including at least five shovels and two axes. One box for two operating within 300 feet satisfactory.

Cal. Stats. 1931, Ch. 311. Penal Code Sec. 384 (10). (Applies to redwood country outside of logging operations May 1 to Oct. 31 only. Does not apply to redwood logging or within municipalities.)

Operating steam donkey, stationary engine, locomotive or loader during same period without an adequate force pump or water under pressure equivalent to a pump



and not less than 200 feet of one-inch minimum hose; one installation covers two engines customarily working within 100 feet of each other.

### **Fire Trespass**

Building fires upon any land owned by another where signs forbidding trespass are displayed at intervals of not over one-third mile apart on exterior boundaries and at all trails and roads entering without first obtaining written permission of owner, his agent or lawful possessor.

Cal. Stats. Sec. 602 (i)  
Penal Code.

### **Fireworks**

Discharging fireworks on any National Forest areas designated as closed therefor. Setting off fireworks in inflammable cover on his or another's land without permit between April 15 to November 30.

Reg. T-1 M., Sec. of Agr.  
Cal. Stats. 1931 Penal Code  
Sec. 384 (3). (Does not  
apply to municipalities.)

### **Incendiarism**

Lighting or by any other means setting fire to growing timber, forest, etc., and destroying property not his own by fire to a value of \$50 or more.

Nevada, Revised Laws,  
1912, Rec. 6633. *Felony.*

### **Permits, Landowner**

Setting on fire or causing to be set on fire cover on lands not his own containing inflammable vegetation without permission of owner between April 15 and November 30; redwood area between May 1 and October 31.

Cal. Stats. 1931, Ch. 311.  
Penal Code Sec. 384 (1).  
(Does not apply inside mu-  
nicipalities.)

### **Rendering Aid**

Refusing or failing to render help in combatting forest fires at summons of State Forester or his agent or other State officer unless prevented from doing so by sickness or other physical disability.

Cal. Stats. 1931, Ch. 311.  
Penal Code, Sec. 384 (11).

### **Registration**

Going or being upon National Forest areas duly designated as areas of fire hazard without being registered.

Reg. T-1 N. Sec. of Agr.  
(Settlers going to and from  
homes exempted.)

**Setting Fires to Miscellaneous Structures and Materials**

Wilfully or maliciously setting fire to bridges costing over \$50 and to tents, fences, lumber, etc., valued over \$25. Cal. Stats. 1905, Sec. 600. *Felony.*

**Setting Fires to Other's Lands (Including National Forest)**

Setting or allowing or causing fires to be set on lands of another, or allowing fires to escape to property of another, wilfully and negligently. Fed. Law. March 4, 1909 (35 Stat. 1098) Sec. 52 Criminal Code. *Felony:* Cal. Stats. 1931, Ch. 311. Penal Code Sec. 384 (1). Cal. Stats. 1931. Ch. 790 Sec. 1. Civil Liability.

**Shovel and Axe**

Going or being upon National Forest lands, designated as of fire hazard, in automobiles or with pack stock without shovel at least 36 inches long, blade 8 inches wide; and axe at least 26 inches long, with 2-pound head. Reg. T-1 O. Sec. of Agriculture. Cal. Stats. 1929, Ch. 115.

**Smoking**

Smoking on duly designated National Forest lands during dangerous periods. Reg. T-1 H., Sec. of Agriculture. Cal. Stats. 1929, Ch. 115. (Places of habitation and posted areas exempted.)

**Spark Arresters**

Using any donkey, logging locomotive, or any other engine or boiler in or near any forest, brush, grass, or stubble, unless proved affirmatively that such had adequate devices to prevent fires from escaping from smokestacks, ash pans, fire boxes, or other parts, and that he has used every reasonable precaution to prevent fires therefrom. Cal. Stats. 1931, Ch. 311. Penal Code Sec. 384 (7). (Does not apply in municipalities or redwood logging.)

Operating engine or boiler not equipped with modern spark arrester in good shape near brush or other fuels. Nevada, Revised Laws, 1912, Sec. 6580.

Operating gasoline tractor, gasoline propelled harvesting machine, oil burning engine, or automobile tractor in harvesting or Cal. Stats. 1931, Ch. 311. Penal Code Sec. 384 (9).



moving grain or hay, or moving said machine in or near grain or grass lands unless equipped with an effective spark arresting device.

## APPENDIX 9

### DIALOGUE BETWEEN GUARD AND CAMP FIRE PERMITTEE

A forest visitor drives up to a Guard Station and enters. The following conversation takes place:

Forest Visitor—Good morning.

Guard (pleasantly)—Good morning. Can I do something for you? (Instead of: What do you want?)

F. V.—I would like to get a camp fire permit.

Guard—Certainly. Won't you have a chair? (Places chair so visitor can write on table comfortably, and hands him a blank permit to fill out; also registration book.) Won't you please read the permit to be sure you understand its provisions, and be very careful to observe the rules for care with fire.

F. V.—It asks how many in party. Should I include my two-year-old son?

Guard—Yes, please include him also. We want a complete record, regardless of age.

F. V.—What is this about a shovel and axe? I never heard of that before. It sounds like a silly rule.

Guard—That is a rule we have had for a great many years, and I'm sorry you did not know about it. We figure that everyone in the woods really wants to help in this fire game; and it is surprising how many fires are found first by campers and are extinguished or kept small because they have a shovel. Then, too, a shovel and axe are handy things to have around camp.

F. V.—But what shall I do? I haven't a shovel and axe with me, and it is a long way back to town.

Guard—Perhaps we can find a way out. How far up the canyon are you going?

F. V.—We had hoped to get to Wrights Lake tonight.

Guard—Fine! You can buy a shovel and axe at Riverton, about fifteen miles up the road from here, and can check these in to the guard at his station. Wait! I'll telephone the store to be sure. The travel has been heavy, and they may be sold out. (Calls Riverton.) Good! They still have some. You'll find the store on the left-hand side of the road, just

after reaching the first river crossing. Will you drop in and show your equipment to the guard who is just beyond there?

F. V.—Well, thanks a lot for your kindness, and I'll surely get the shovel and axe on the way up.

Guard—Have a good time. If you want any dope on fishing above Wrights Lake, don't hesitate to ask Jack Benny, the patrolman. You'll see him at the camp ground every Tuesday, Thursday, and Saturday morning; and he knows the country like a book.

F. V.—Thanks again, and good-bye.

Guard—Good-bye (and waves hand). (Guard calls Patrolman Benny and gives him name and car license number of visitor, and asks him to check up on shovel and axe.

## APPENDIX 10

### SAMPLE PORTION OF DISPATCHER LOG

| Time          | <i>Temporary No.</i> |                         | <i>Action</i>  |
|---------------|----------------------|-------------------------|--|
|               | <i>or</i>            | <i>Initials of Fire</i> |  |
| July 3, 1936. |                      |                         |  |
| 3:20 A.       | 44                   |                         | Camp Boss Hanks ordered supplies for Post Camp by 11:00 A.M. List given. Hanks will give condition report around 8:00 A.M. |
| 3:32 A.       | 44                   |                         | Radio message from Smith, Read Meadow Camp, situation lots better. Ordered supplies.                                       |
| 3:50 A.       | 44                   |                         | Olson, Camp Comfort, reports two truck loads, 52 men, left to report to Anderson in time to be on west line by 4:00 A.M.   |
| 4:25 A.       | 48                   |                         | Henderson, Black Mt., thinks he sees snag burning at point lightning strike of 7-1 reading 220. Will check with Mt. Thom.  |
| 4:26 A.       | 48                   |                         | Called Jones, Mt. Thom. Can just see smoke reading 12 on Pastor Ridge.   |
| 4:28 A.       | 48                   |                         | Sent Phillips with Jones from Strawberry Glade. Told him how to go in.   |
| 4:29 A.       | 48                   |                         | Told Henderson of Jones' reading.  |



# APPENDIX 11

## SAMPLE NON-FIRE JOB LIST

The guard will be expected to perform certain work on improvements at his station at times when this will not interfere with his fire duties. They will be covered by a written job list supplied by the Ranger. A sample form is shown below:

### GUARD JOB LIST

(Non-Fire)

Season 193....

Forest.....

Station.....

|  | Date Assigned | Date to be Completed | Date Completed (Guard enters and initials) |     |
|--|---------------|----------------------|--|-----|
| 1. Dig ditch from new tank house to dwelling on line marked. | 6-1           | 7-15                 | 7-2  | ABO |
| 2. Repair front gate.  | 6-1           | 6-15                 | 6-4  | ABO |
| 3. Lay new linoleum in kitchen when received.                | 6-1           | .....                | 6-12                                       | ABO |
| 4. Reset telephone pole by corner of woodshed.               | 7-6           | 7-30                 |  |     |
| 5. Make up 500 telephone ties.                               | 8-2           | 9-30                 |  |     |
| 6. Other jobs.   |               |                      |  |     |

## APPENDIX 12

### REPORT FORMS USED BY GUARDS

No detailed instructions for preparation of reports are included, because necessary instructions are contained on the form or are supplied with them. When difficulty is experienced in filling out any form, consult the Ranger.

Due dates for the reports required of guards will be furnished by the Supervisor.

| <i>Form<br/>Number</i> | <i>Form Name</i>                         |
|------------------------|--|
| E-1                    | Lookout Check Report                     |
| E-2                    | Report of Suppression Crew               |
| E-3                    | Tank Truck Report                        |
| E-4                    | Report of Use of Water on Fires          |
| CA-1                   | Accident Report Form                     |
| 13-R-5                 | Notice to Appear                         |
| 15-R-5                 | Field Record of Camp Fire Permits Issued |
| 26 and 27              | Motor Accident Report                    |
| 289                    | Field Note Book                          |
| 449-a                  | Register for all Visitors                |
| 592                    | Fireman's Report                         |
| 618-b-R5               | Report to Supervisor                     |
| 833                    | Registration of Recreational Visitors    |
| 874-8                  | Free-use Permit                          |
| 874-15                 | Time Report                              |
| 874-15a                | Fire Time Slips                          |
| 874-20                 | Law Enforcement Report                   |
| 874-28-R5              | Camp Fire Permit                         |
| 874-29                 | Activities or Elements of Cost           |
| 876                    | Note Book for Use on Fires               |
| 877                    | Purchase Order Book                      |
| 1100                   | Lightning Storm Report                   |
|                        | Dispatcher Lightning Strike Record Form  |
| 1009-c                 | Ten-day Weather Report                   |
|                        | Dispatcher's Log Book                    |
|                        | Lookout Fire Report                      |
|                        | Dispatcher Check List                    |
|                        | Standard Instructions to Timekeepers     |
|                        | Lookout Log Book                         |
|                        | Self-inspection Form                     |
| State of<br>California | Burning Permit                           |



# APPENDIX 13

## DISPATCHER CHECK LIST

Upon receiving report determine the following:

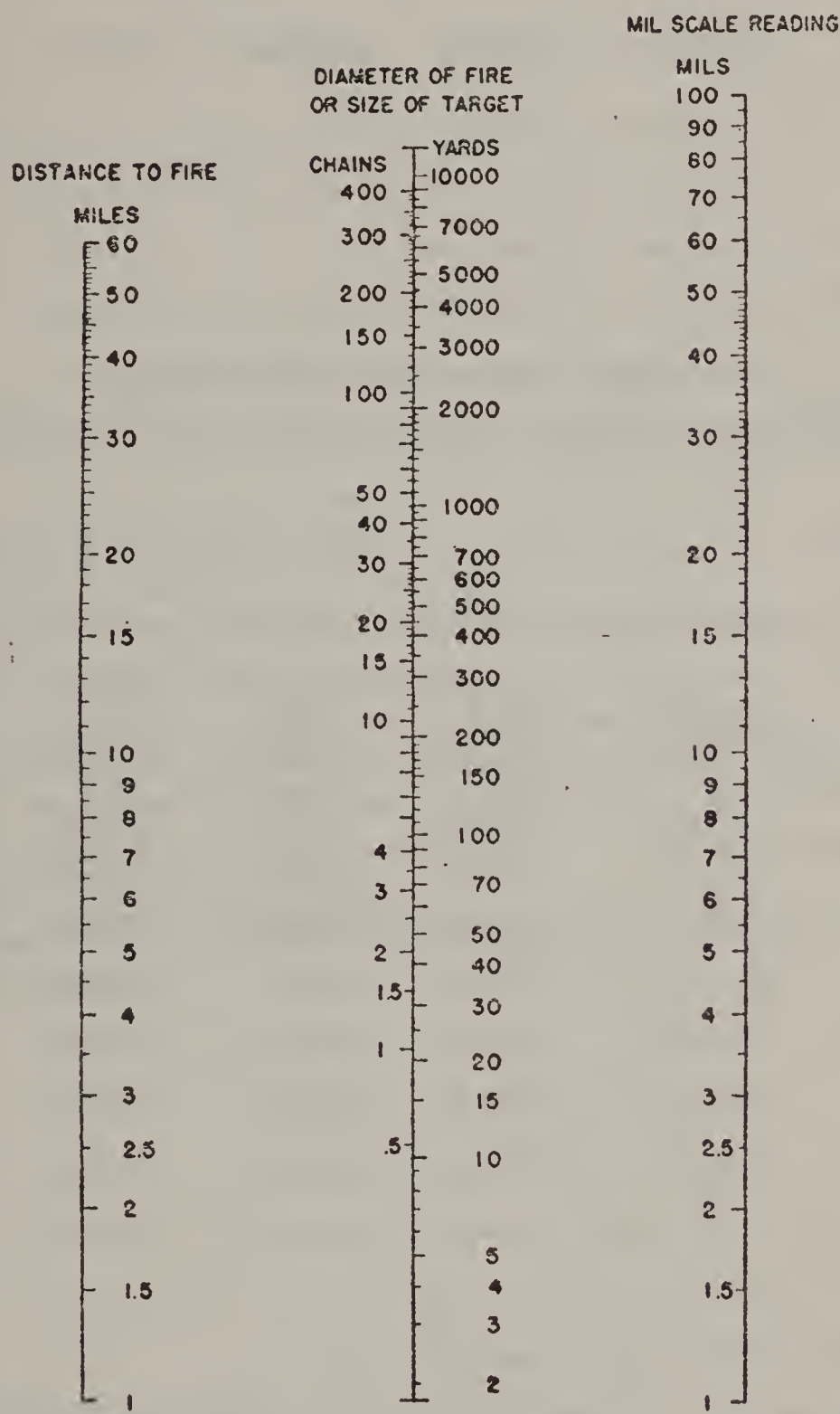
- |                                   |   |
|-----------------------------------|---|
| 1. Time of report                 | 12. Last temperature and humidity reading |
| 2. Person and station reporting   | 13. Can reporting party be reached later  |
| 3. Location of fire               | 14. Is anyone working on fire             |
| 4. Azimuth and vertical reading   | 15. Probable cause of fire                |
| 5. Approximate size of fire       | 16. Best and quickest way to fire         |
| 6. Rate of spread                 | 17. Other lookout readings                |
| 7. Cover type                     | 18. Indicate reading on map               |
| 8. Direction traveling            | 19. Check panoramic photographs           |
| 9. Smoke: color, volume and drift | 20. ....                                  |
| 10. Visibility                    |   |
| 11. Wind direction and velocity   |   |

In starting suppression action has dispatcher:

- |  |   |
|--|---|
| 1. Sent nearest patrolman                    | 19. Notified adjacent Forest and cooperators  |
| 2. Sent nearest crew                         | 20. Provided cover up for patrol areas        |
| 3. Sent nearest tank trucks                  | 21. Kept posted on developments through L.O.  |
| 4. Notified District Ranger                  | 22. Provided ample transportation             |
| 5. Sent follow-up men, equipment and lunches | 23. Provided ample communication facilities   |
| 6. Provided for pack stock if needed         | 24. Provided radio and telephone operators    |
| 7. Notified Forest Supervisor                | 25. Sent sufficient portable pumpers and hose |
| 8. Put other crews on standby                | 26. Anticipated use of special equipment      |
| 9. Put other personnel on standby            | 27. Sent auxiliary water supply tanks         |
| 10. Sent sufficient overhead to handle crews | 28. Called fire weather unit if available     |
| 11. Sent sufficient tools and equipment      | 29. Called for special fire weather forecast  |
| 12. Sent fire camp equipment                 | 30. Sent the 3:00 P.M. R.O. report            |
| 13. Sent fire boss staff                     | 31. ....                                      |
| 14. Sent sufficient fire camp overhead       | 32. ....                                      |
| 15. Sent sufficient bedding                  |   |
| 16. Sent a messing company                   |   |
| 17. Notified Army at CCC District H.Q.       |   |
| 18. Notified adjacent District Ranger        |   |

APPENDIX 14

CHART FOR USE WITH MIL-SCALE  
TO OBTAIN DIAMETERS OF FIRES





# APPENDIX 15

## DISPATCHERS LIGHTNING STRIKE RECORD

GENERAL AREA \_\_\_\_\_

DATE \_\_\_\_\_ 193 \_\_\_\_\_ TEMPORARY NAME OR NO. \_\_\_\_\_

|                                  | LOOKOUT | LOOKOUT | LOOKOUT | LOOKOUT | LOOKOUT |
|----------------------------------|---------|---------|---------|---------|---------|
| <i>Time of Receipt</i> _____     | _____   | _____   | _____   | _____   | _____   |
| <i>Azimuth</i> _____             | _____   | _____   | _____   | _____   | _____   |
| <i>Vertical Angle</i> _____      | _____   | _____   | _____   | _____   | _____   |
| <i>Miles Distant</i> _____       | _____   | _____   | _____   | _____   | _____   |
| <i>Fire Direction is</i> _____   | _____   | _____   | _____   | _____   | _____   |
| <i>" Distance is</i> _____       | _____   | _____   | _____   | _____   | _____   |
| <i>" from</i> _____              | _____   | _____   | _____   | _____   | _____   |
| <i>It is a spot</i> _____        | _____   | _____   | _____   | _____   | _____   |
| <i>Small</i> _____               | _____   | _____   | _____   | _____   | _____   |
| <i>Large</i> _____               | _____   | _____   | _____   | _____   | _____   |
| <i>Can be seen</i> _____         | Yes     | Yes     | Yes     | Yes     | Yes     |
| <i>direct.</i> _____             | No.     | No      | No      | No      | No      |
| <i>Is over intervening</i> _____ | Yes     | Yes     | Yes     | Yes     | Yes     |
| <i>ridges</i> _____              | No      | No      | No      | No      | No      |
| <i>Is it burning</i> _____       | Single  | Single  | Single  | Single  | Single  |
|                                  | Snag    | Snag    | Snag    | Snag    | Snag    |
| <i>"</i> _____                   | On      | On      | On      | On      | On      |
| <i>"</i> _____                   | Ground  | Ground  | Ground  | Ground  | Ground  |
| <i>"</i> _____                   | In      | In      | In      | In      | In      |
| <i>"</i> _____                   | Brush   | Brush   | Brush   | Brush   | Brush   |
| <i>Smoke is</i> _____            | White   | White   | White   | White   | White   |
| <i>"</i> _____                   | Black   | Black   | Black   | Black   | Black   |
| <i>"</i> _____                   | Thin    | Thin    | Thin    | Thin    | Thin    |
| <i>"</i> _____                   | _____   | _____   | _____   | _____   | _____   |
| <i>Total No. of</i> _____        | _____   | _____   | _____   | _____   | _____   |
| <i>Strikes.</i> _____            | _____   | _____   | _____   | _____   | _____   |
| <i>Suppression Action</i> _____  | _____   | _____   | _____   | _____   | _____   |

Appendix 15(a)

Dispatchers Initials \_\_\_\_\_

## **INSTRUCTIONS FOR USE OF DISPATCHER LIGHTNING STRIKE RECORD**

Make out one form for each report.

Keep reports from same general area together.

As readings are matched up and fires are located enter just the other azimuth readings or staple all together.

In trying to match up the readings from different lookouts on map work sheet, all of the lookout reports that are believed to relate to the same fire can be put on one sheet for comparison.

Save the forms and cross-refer to dispatcher log book if data therein does not include all of that on forms.

Can also use form on follow-up report recording and in other concentrations if desired.





## **INSTRUCTIONS FOR PREPARING LIGHTNING STRIKE RECORD**

Make one copy to be turned in to Ranger at end of each month.

Use separate sheet for each large area in which strikes occur, describing this on form.

Fill in columns No. 1 and No. 2 only on strikes. As smokes show up, fill in rest of columns and report on all headings on form to dispatcher on such strikes that have developed into fires.

Columns 2 and 4: Give best estimated figures.

Column 7: Put in name of closest natural feature, such as ranch, meadow, mountains, etc.

Columns 8, 9, 10: Check one applicable.

Columns 11, 12: Check one applicable.

Columns 13 to 15: Check one applicable or put descriptive initials in column as reminder of situation for report to dispatcher.

Columns 17 to 19: Check one applicable or describe by key initials distinctive character in column 20.



# APPENDIX 16

## BEAUFORT SCALE

| Beau-<br>fort<br>No. | Explanatory titles   | Specifications for use on land  | Miles<br>per hour<br>(statute) | Terms used<br>in United<br>States<br>Weather Bu-<br>reau forecast |
|----------------------|----------------------|---|--------------------------------|---|
| 0                    | Calm.....            | Calm; smoke rises vertically.....   | Less<br>than 1                 | Light   |
| 1                    | Light air.....       | Direction of wind shown by<br>smoke drift, but not by<br>wind vanes .....                                   | 1-3                            |   |
| 2                    | Slight breeze.....   | Wind felt on face; leaves<br>rustle; ordinary vane<br>moved by wind.....                                    | 4-7                            |   |
| 3                    | Gentle breeze.....   | Leaves and small twigs con-<br>stant motion; wind extends<br>light flag .....                               | 8-12                           | Gentle  |
| 4                    | Moderate breeze..... | Raises dust and loose paper;<br>small branches are moved....  | 13-18                          | Moderate  |
| 5                    | Fresh breeze.....    | Small trees in leaf begin to<br>sway; crested wavelets<br>form on inland waters.....                        | 19-24                          | Fresh   |
| 6                    | Strong breeze.....   | Large branches in motion;<br>whistling heard in telegraph<br>wires; umbrellas used with<br>difficulty ..... | 25-31                          | Strong  |
| 7                    | High wind.....       | Whole trees in motion; incon-<br>venience felt in walking<br>against wind.....                              | 32-38                          |   |
| 8                    | Gale.....            | Breaks twigs off trees; gener-<br>ally impedes progress.....  | 39-46                          | Gale  |
| 9                    | Strong gale.....     | Slight structural damage oc-<br>curs (chimney pots and<br>slate removed).....                               | 47-54                          |   |
| 10                   | Whole gale.....      | Seldom experienced inland;<br>trees uprooted; consider-<br>able structural damage oc-<br>curs .....         | 55-63                          |   |
| 11                   | Storm.....           | Very rarely experienced; ac-<br>companied by widespread<br>damage.....                                      | 64-75                          | Whole<br>gale   |
| 12                   | Hurricane.....       |   | Above<br>75                    | Hurricane   |

PART II

General Section





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# BACKGROUND AND PURPOSE OF THE HANDBOOK

Knowledge of sound fire control practices, in addition to those set forth in the Guard Handbook, has accumulated as a result of research and experience. Every large fire has had peculiarities in behavior. These have caused infinite variety in the problems of planning encountered by the fire boss, in the methods and form of organization that are most effective in control. Much, too, has been learned regarding practices in preparedness and prevention.

This accumulated experience has been available only in part to any individual. It has not been fully analyzed to determine what additional facts are needed to raise the professional level of fire control.

The Handbook attempts to codify and make readily available the lessons and sound practices already established, and to indicate classes of additional information most urgently needed to perfect the application of what is now known.



## HOW TO USE THE HANDBOOK

1. The form of the Handbook is such that it is suited to field use. Much of the material is of every-day application, so it should be used in the field as well as in the office.
2. The material in the Guard Section is not repeated. The two sections are the Region 5 Fire Control Handbook.
3. Study the principles of action. The subjects are treated in the Handbook so you can study them in detail and apply them as need arises.
4. Study the table of contents and index. Run down enough subjects so that you know the plan of arrangement.
5. Consider the fire problems. See how the one crew in the Guard Section is expanded in the big fire organization. Put the men in your own organization into the key positions to give the situations local color.
6. Study the suppression and prevention problems one by one. Transfer the situations into your own territory and see how the principles apply.
7. The Handbook attempts to develop principles and practices essential in the fire suppression job. Application to specific situations in the field is the job of the reader.
8. Insofar as practicable, the Handbook covers all general standing instructions and statements of policy governing fire control on the National Forests of the Region.



# **SUPPRESSION**

## **FOREST SERVICE SUPPRESSION POLICY**

The approved policy calls for fast and energetic suppression of all fires in all types during dangerous fire weather.

When immediate control is not thus attained, consider all elements of the situation and calculate the probabilities of spread. Develop the organization to control the fire within the first work period. Failing in this, the attack for each succeeding day will be planned and executed with the aim of controlling the fire by not later than the beginning of the burning period the next morning. In any case not later than 10:00 A.M.

No fixed rule can be given to meet every situation; the spirit implied in the policy will determine the action to be taken in doubtful situations.

Recognized dispatching policy is as follows:

1. *For large fires having:*

- (a) Abundant supply of labor readily available.
- (b) Travel time for crews less than two hours.
- (c) Conditions such that if fire is not caught with extreme promptness and certainty it is likely
  - a. to spread rapidly and indefinitely.
  - b. to do serious damage.

Correct dispatcher action is to send immediately crews and adequate overhead until all men who can be handled effectively with available overhead have gone, or until orders to stop are received from competent authority.

2. *For small fires*

On a fire so small that the method of estimating perimeter does not seem to apply, the dispatcher should send enough men to make him feel confident the fire will be corralled during first work period and held thereafter even if fire should prove to be more difficult than could logically be foreseen.

## **PLANNING FIRST-SHIFT ATTACK ON GOING FIRES**

### **FOREWORD**

Once a fire has escaped initial attack, and will obviously attain a size requiring big fire organization, that is, more than one-crew attack, the process by which attack is planned is generally either:

1. Calling on accumulated personal experience and knowledge of similar fires in the same or similar country. (Clearly, this method is usable only by men with rich and extensive background for the existing conditions. Such fire fighting is an art, not a science.)

2. Using the accumulated experience of a fire guard in the same manner as above when the Ranger lacks background.
3. Mobilizing all or nearly all the men, equipment, overhead, etc., available. This commonly results when the situation at the moment is bad, and the planner is completely uncertain as to the future behavior of the fire.
4. The attempt by men with both rich experience and analytical minds to estimate where the fire will be at the time they can get the major attack under way, and work back from there to determine location of camps and crews, strategy, location of lines, etc. This process approaches a science within the limits of knowledge of the effects on fire behavior, of wind, slope, humidity, and cover and of unit output per man-hour of constructed and held line.

The quality of planning first-shift attack determines whether the fire will be held or lost, whether costs will be reasonable or otherwise, and whether size will be held to a minimum.

The process has to be done rapidly, so that mobilization can proceed and the general attack can be begun as early as possible.

By no means are all the needed facts on fire behavior, rates of line building, etc., now known with enough accuracy so that attack can be planned as precisely as, for example, construction of a road. There are, however, guides, based on research and accumulated experience, which remove the steps in attack planning from the realm of guesswork or personal opinion.

It has seemed worth while to put down the successive steps in planning which are needed on all fires, together with the guides, in the form of generally applicable facts, which may be useful in individual cases. Obviously, we are a long way from reducing this complex and difficult process to a series of airtight formulas. The material cannot be used to solve directly the pressure problems that arise with each uncontrolled fire. But since the Region is committed to surveys and studies which will add greatly to the quantitative facts now available, it is important that at least the *process* of planning attack be systematized and generally understood. With such an understanding, the new facts can be effectively put to use as they become available.

## **APPRAISING PROBABLE BEHAVIOR OF FIRE AS BASIS FOR PLANNING ATTACK**

### **The Problem in General**

There is an uncontrolled fire. Obviously it will require organization beyond a one-crew basis. It will take time—say until 6:00 P.M.—to mobilize and get first-shift night organization effective on the line.



You need to know first where the fire will be at 6:00 P.M. and at later periods. All planning of strategy, total man-power needed, and placing of crews and camps, starts from the appraisal of what you will be attacking then and at subsequent key periods, not on what the fire is now.

There is no simple rule or formula to solve this problem, because the problem is always complex, with several important variables, and an exact proved formula for any one variable does not exist. But an intelligent estimate is better than a wild guess, so an attempt to take advantage of what is known about fire behavior is always worth while.

### **Elements of Fire Behavior**

The elements to take into account, and the process of combining them into an appraisal of probable behavior of the fire, are discussed below.

#### *1. Current dryness of fuels*

The fuel moisture stick is a standard instrument. Forty-five stations on five Forests will be set up in 1937, and more stations in later years.

Pending the development of a scale of current numerical danger ratings, it is desirable to rate the danger due to dryness of fuels in general terms as follows:

Class 1. Slight. High fuel moisture content barely permitting fire to spread.

Class 2. Low.

Class 3. Medium.

Class 4. High.

Class 5. Very high.

Class 6. Extreme. Driest days, critical year, mid or late season.

In estimating rates of spread there must be added to the above measures of dryness of fuel the effect of wind, humidity and slope.

#### *2. Current wind velocity*

Analysis of California fire reports indicates that with humidity constant, the relative effects on the rate of spread (expressed in perimeter increase), of various general wind velocities, are approximately as follows:

7-mile wind (slight breeze on Beaufort scale) produces 1 unit length of perimeter

12-mile wind (gentle breeze) produces 2 unit lengths of perimeter

18-mile wind (moderate wind) produces 2.8 unit lengths of perimeter

23-mile wind (fresh breeze) produces 3.2 unit lengths of perimeter

30-mile wind (strong breeze) produces 3.4 unit lengths of perimeter

For example, if, with the same level of fuel dryness, a previous similarly located fire with slight breeze spread to a perimeter of 70 chains in 1 hour, then expect for a current fire with a wind of fresh breeze velocity, 224 chains ( $3.2 \times 70$ ) perimeter in the first hour. The area corresponding to an

average-shaped fire with 70 chains perimeter is about 17 acres, and that corresponding to 224 chains is a little less than 180 acres. To obtain relationship between area and perimeter, see table, Appendix 17.

These relative indices are the best available approximations of the effect of wind on rate of spread, but are subject to modification as more information becomes available.

3. *Current relative humidity*

Analysis of California fire reports indicates that when wind remains constant but relative humidity varies, the relative rates of fire perimeter increase are approximately as follows:

- 43% relative humidity produces 1 unit length of perimeter
- 35% relative humidity produces 1.4 unit lengths of perimeter
- 28% relative humidity produces 2 unit lengths of perimeter
- 20% relative humidity produces 2.8 unit lengths of perimeter
- 15% relative humidity produces 3.2 unit lengths of perimeter

For example, if, with the same level of fuel dryness and wind velocity, a previous, similarly located fire with 43% relative humidity spread to a perimeter of 50 chains in one hour, then expect for a current fire with a relative humidity of 15%, 160 chains ( $50 \times 3.2$ ) perimeter in the first hour.

Refer to perimeter-area table, Appendix 17, which gives the following area equivalents to the above perimeters: 50 chains—9 acres, 160 chains—90 acres.

The above relative rates of increase due to relative humidity are the best available approximations, and are subject to change as more data are secured.

4. *Combined effect of wind and relative humidity*

Rate of Spread Expressed in Units of Perimeter  
(Wind velocity in miles per hour)

| Relative Humidity % | 5 - 10 | 11 - 15 | 16 - 20 | 21 - 25 | 26 - 35 |
|---------------------|--------|---------|---------|---------|---------|
| 41 - 45 .....       | 1      | 2       | 2.8     | 3.2     | 3.4     |
| 31 - 40 .....       | 1.4    | 2.8     | 3.92    | 4.48    | 4.76    |
| 26 - 30 .....       | 2      | 4       | 5.6     | 6.4     | 6.8     |
| 16 - 25 .....       | 2.8    | 5.6     | 7.84    | 8.96    | 9.52    |
| 15 or less .....    | 3.2    | 6.4     | 8.96    | 10.24   | 10.88   |

Approximations only—subject to change.

For example, if a fire developed a perimeter of 45 chains in one hour, with a relative humidity of 41 - 45%, and a wind velocity of 5 - 10 miles per hour, a similarly located fire could be expected, with a relative humidity of 16 - 25%, and a wind of 21 - 25 miles per hour, to produce 403 chains



(45 × 8.96) of perimeter in one hour. From Appendix 17 the area corresponding to 45 chains perimeter is about 7 acres, and that for 403 chains perimeter is approximately 600 acres.

5. *Effect of slope*

Tentative conclusions from rate of spread field experiments indicate the following effect of slope on the rate of fire perimeter increase :

| Wind Velocity<br>V | Slope — Per Cent |      |      |      |      |      |
|--------------------|------------------|------|------|------|------|------|
|                    | 0                | 10   | 20   | 30   | 40   | 50   |
| 0.....             | 1.00             | 1.00 | 1.05 | 1.15 | 1.20 | 1.25 |
| 5.....             | 1.00             | 1.02 | 1.20 | 1.55 | 1.90 | 2.25 |
| 10.....            | 1.00             | 1.07 | 1.42 | 1.92 | 2.40 | 2.90 |
| 15.....            | 1.00             | 1.15 | 1.63 | 2.26 | 2.88 | 3.50 |
| 20.....            | 1.00             | 1.21 | 1.85 | 2.60 | 3.35 | 4.13 |
| 25.....            | 1.00             | 1.27 | 2.05 | 2.92 | 3.85 | 4.75 |
| 30.....            | 1.00             | 1.35 | 2.27 | 3.28 | 4.34 | 5.40 |
| 35.....            | 1.00             | 1.41 | 2.46 | 3.60 | 4.82 | 6.00 |
| 40.....            | 1.00             | 1.47 | 2.68 | 3.95 | 5.30 | 6.65 |

For example, if with all conditions except wind and slope constant, a previous fire with a 5-mile wind on level ground produced 60 chains perimeter in one hour, then for a current fire with a 5-mile wind, but on a 20% slope, we could expect in an hour a 72-chain perimeter (1.20 × 60. See table).

The above table is subject to change as more data are secured.  
For areas corresponding to the above perimeters, see table, Appendix 17.

6. *Changes in cover type that will increase spread*

- a. Sizeable areas of flash type, such as grass, buckwheat, sagebrush.
- b. Cut-over lands.
- c. Old burns with snags which cause spot fires.
- d. Brushfields.

No data on rate of spread by types are available. Judgment will have to be used in appraising the effect of type changes on rate of spread.

7. *Barriers that will reduce spread*

- a. Ridges in path of fire changing spread from uphill to downhill.
- b. Cliffs, slides, etc., that will stop, slow down, or break up fire.
- c. Resistant cover types that fire will reach—heavy fir, meadow, etc.
- d. Canyons, gulches and streams that will check fire.
- e. Recent burns.
- f. Firebreaks, wide rights-of-way, etc., that should stop most of fire, allowing only spots or stringers to cross.

## 8. *Time of day*

- a. Estimate number of hours until normal shift in weather conditions, for which rate of spread, based on current conditions, will be calculated from 2, 3, 4 and 5, above.
- b. If persistence of current conditions through night is indicated, calculate spread accordingly.

## 9. *Weather prediction*

- a. Obtain, if available, special forecast from mobile Weather Bureau forecasting unit on:
  1. Number of hours current conditions will remain substantially constant.
  2. Changes in temperature, relative humidity, wind velocity, and wind direction.
- b. Use in any event general fire weather forecast of Weather Bureau as basis for estimating:
  1. Whether or not night conditions will be normal.
  2. Whether next day will be worse or better than current day.
- c. Recognize such obvious things as:
  1. Persistent Mono, Santa Ana, or north and east winds with continued low relative humidity.
  2. Usual hour for shift from up-canyon to down-canyon wind.
- d. Use of normal behavior charts.

In normal summer weather at mountain stations there is a fairly regular daily course from hour to hour of wind velocity and relative humidity. If, normally, wind velocity is twice as great at 2:00 P.M. as at 6:00 A.M. or 8:00 P.M., that is useful in calculating probable spread; and, similarly, if normally relative humidity is 20 or 30 points lower from 2:00 to 4:00 P.M. than at 8:00 P.M., that fact can be useful.

There are, in addition, normal seasonal trends in both wind velocity and relative humidity; and there is a fairly regular average relation between wind velocity and elevation.

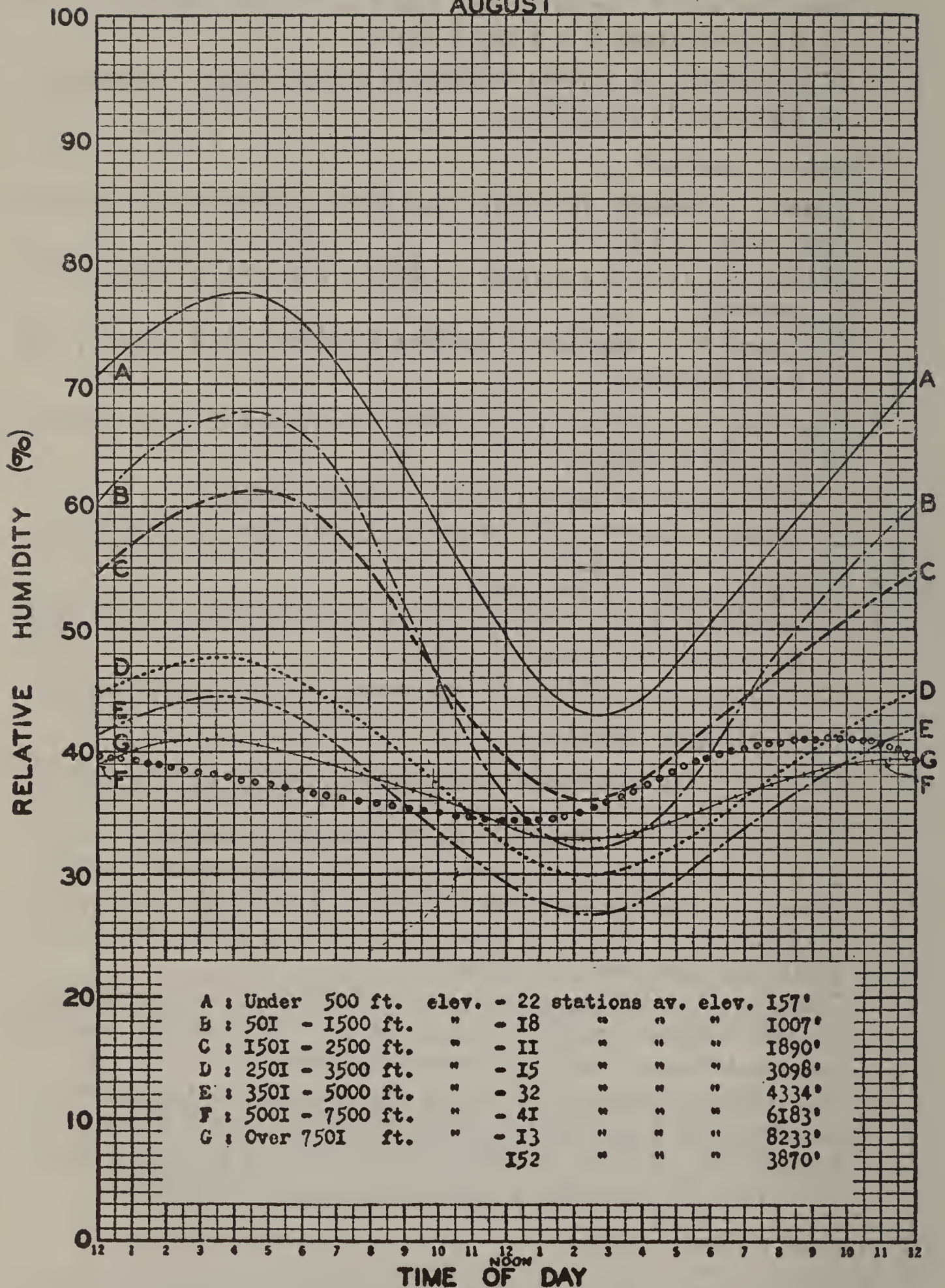
All of these normal curves can be used as guides in the absence of detailed local forecasts. The departure from normal of wind and humidity at the time of estimating spread on a going fire should assist greatly in forming a picture of probable behavior.

## 10. *Normal behavior charts*

The following Normal Behavior Charts are for use in determining the departure of current conditions from average or normal:

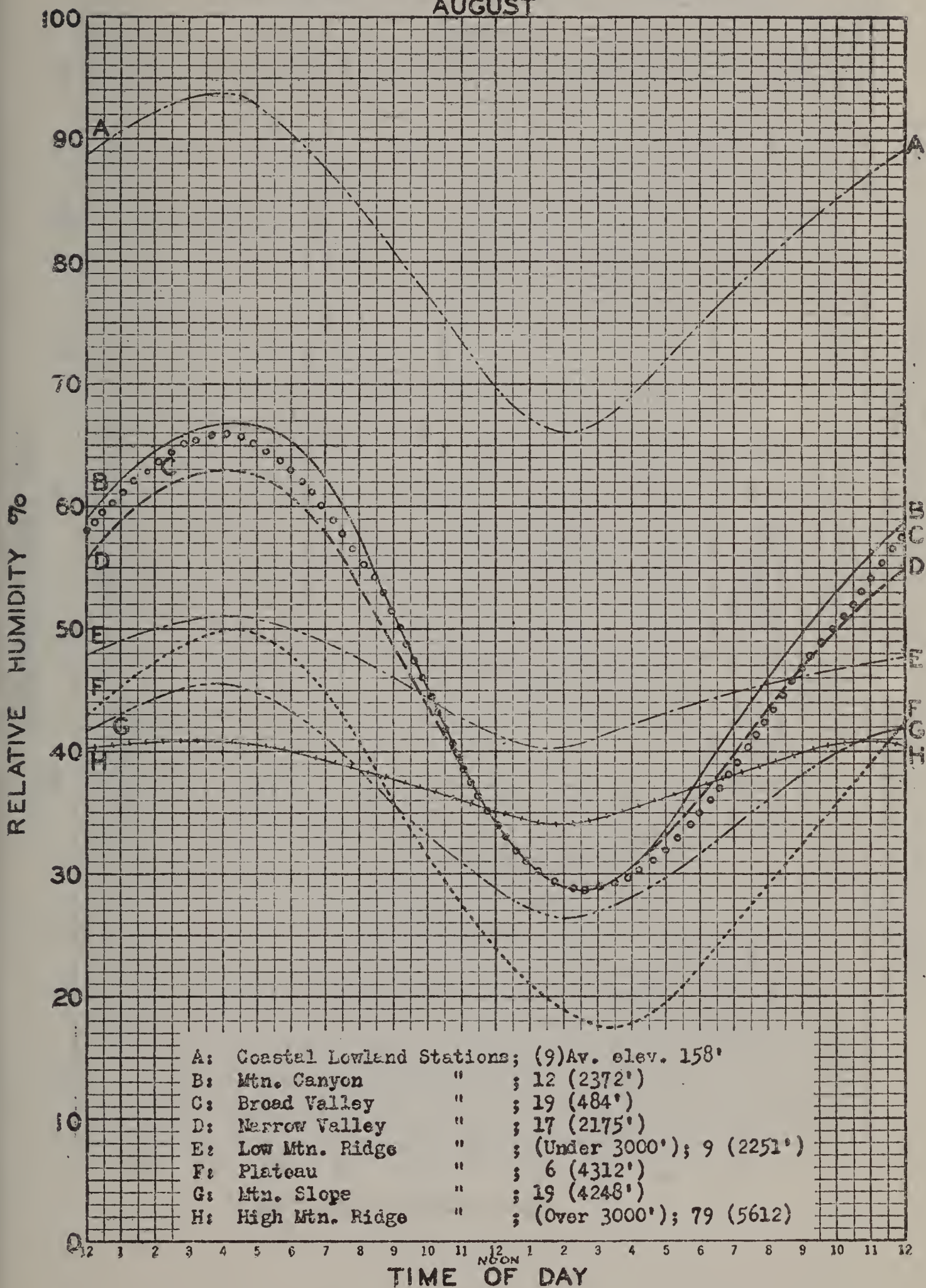


AVERAGE RELATIVE HUMIDITY (%)  
(BASED ON 152 CALIFORNIA STATIONS 1927-34 INCL.)  
TYPICAL CURVES FOR DIFFERENT ELEVATIONS  
AUGUST



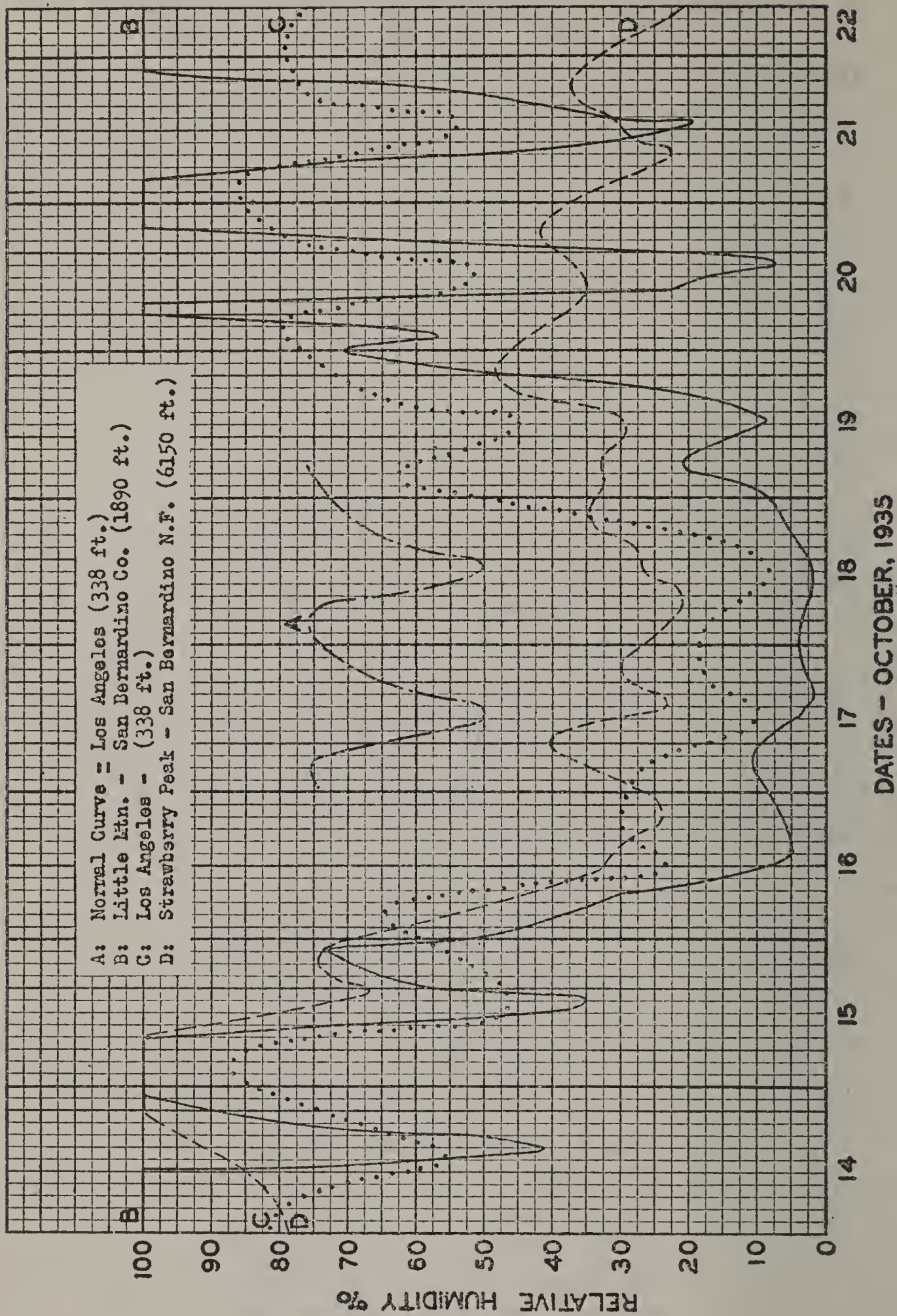


**AVERAGE RELATIVE HUMIDITY %**  
**(BASED ON 152 CALIFORNIA STATIONS 1927-34 INCL)**  
**IN RELATION TO TIME AND TOPOGRAPHY**  
**AUGUST**





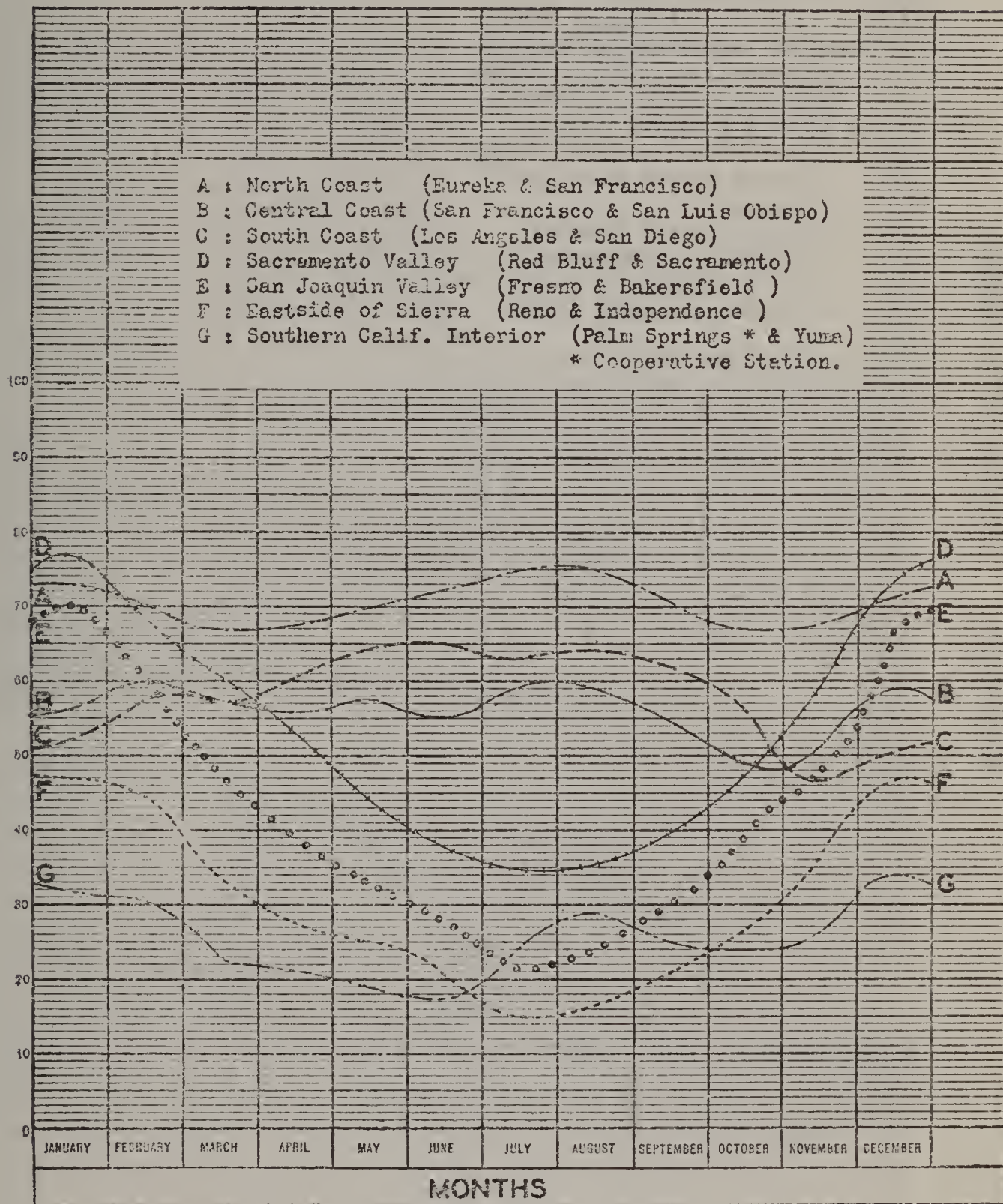
TYPICAL DAILY COURSE OF RELATIVE HUMIDITY DURING SANTA ANAS,  
MONOS, AND NORTHERS. OCTOBER 14-21, 1935





# TYPICAL SEASONAL COURSE OF NOON RELATIVE HUMIDITY AT MAJOR WEATHER BUREAU STATIONS IN CALIFORNIA.

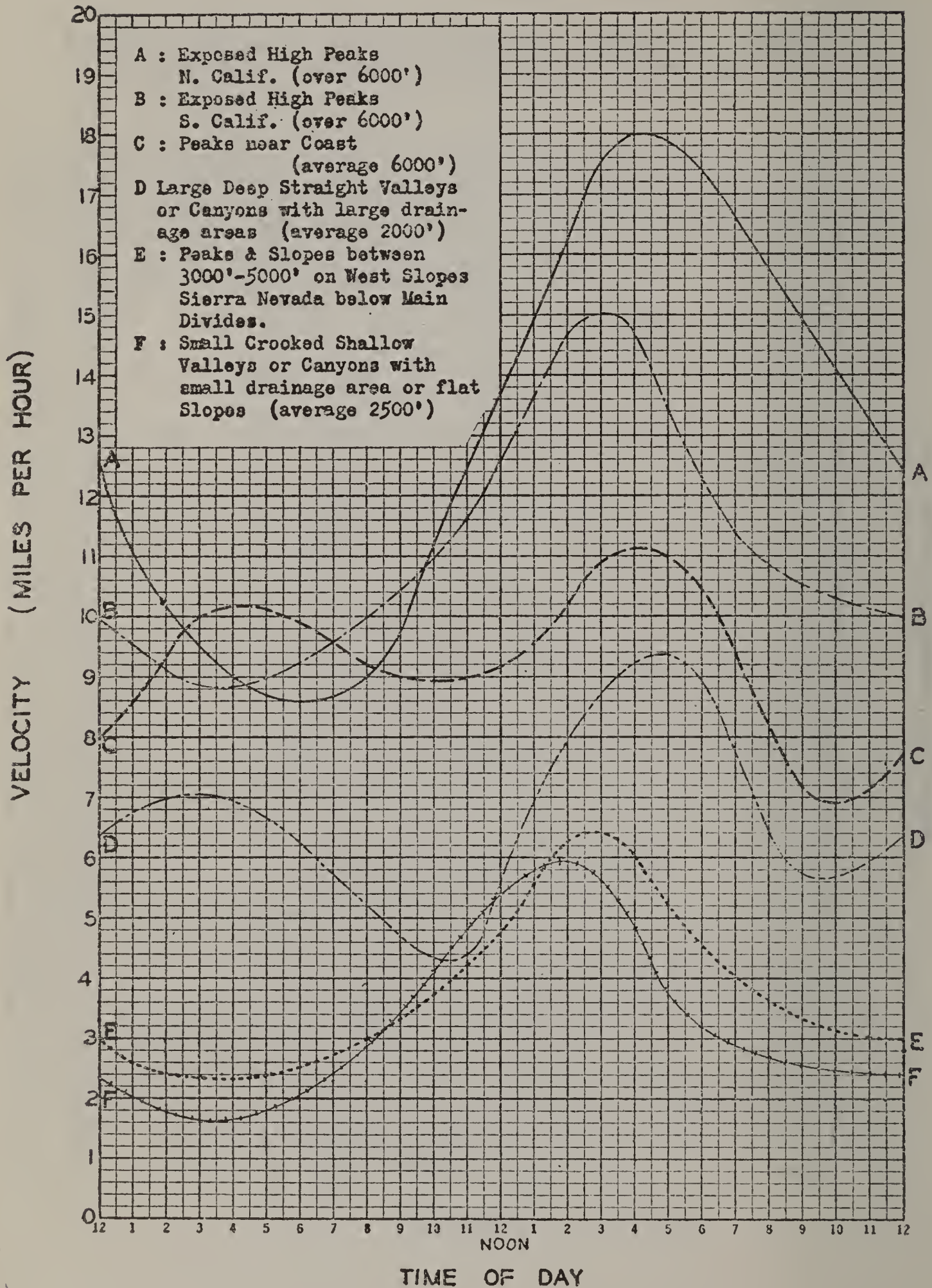
RELATIVE HUMIDITY (%)



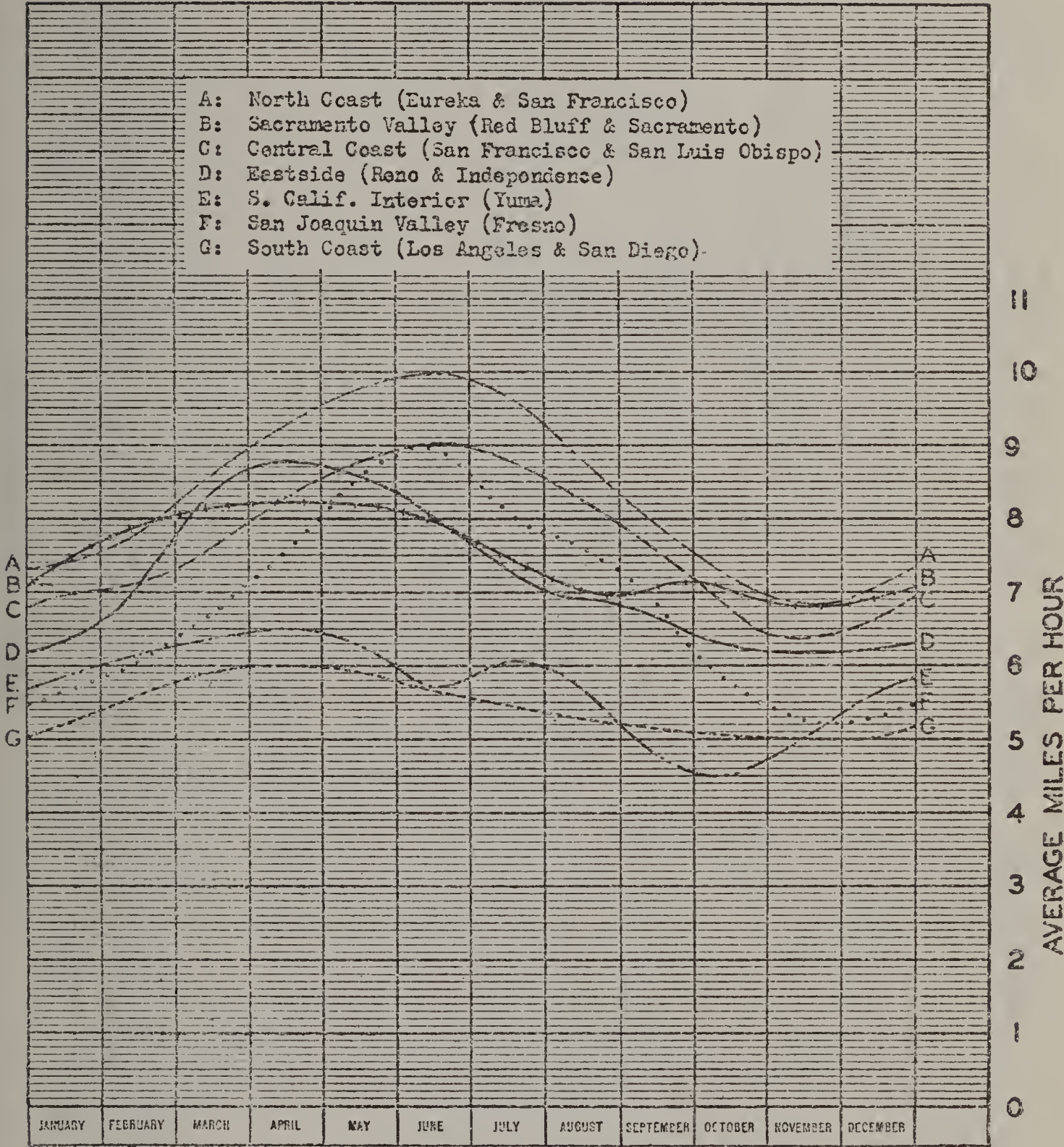


# NORMAL DAILY COURSE OF WIND VELOCITY (AUGUST)

(BASED ON 32 SELECTED STATIONS 1933-1936)

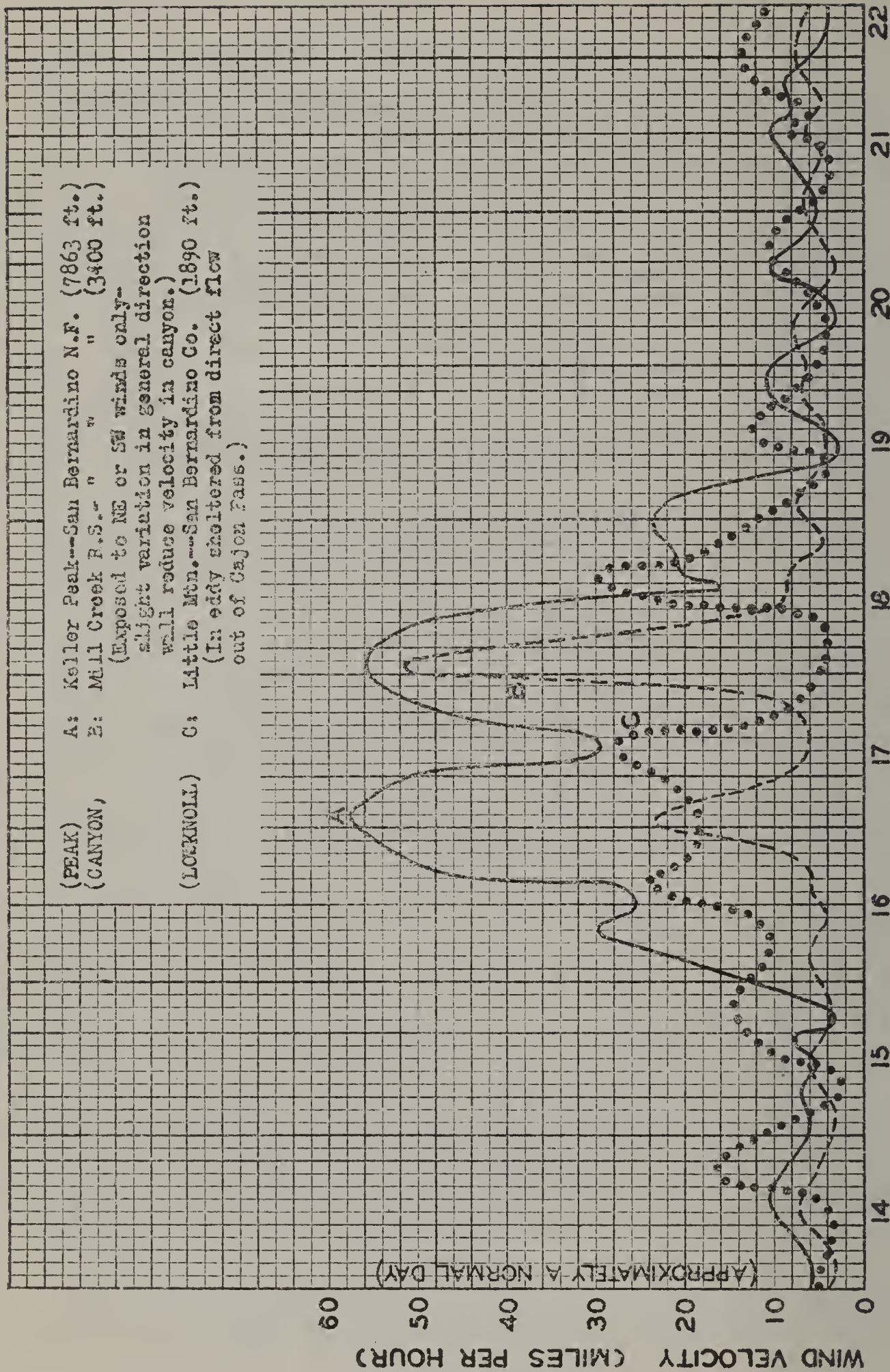


NORMAL SEASONAL COURSE OF AVERAGE HOURLY WIND VELOCITY  
AT MAJOR WEATHER BUREAU STATIONS.





# TYPICAL DAILY COURSE OF WIND VELOCITY DURING SANTA ANAS, MONOS, AND NORTHERS.      OCTOBER 14-21, 1935

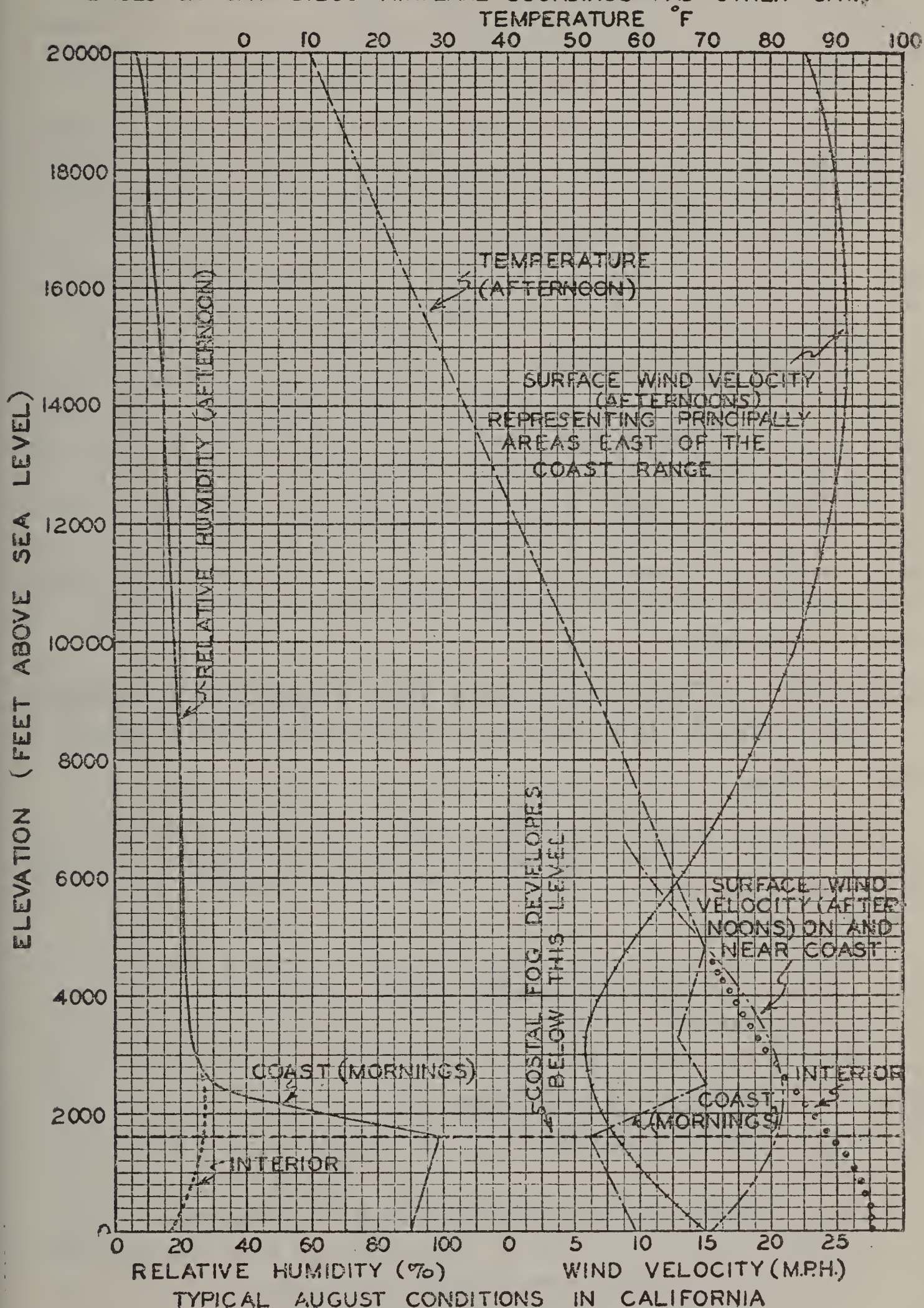


DATES - OCTOBER, 1935



# TEMPERATURE, HUMIDITY, AND WIND VELOCITY, IN RELATION TO ELEVATION

BASED ON SAN DIEGO AIRPLANE SOUNDINGS AND OTHER DATA





## 11. *Relationship of area to perimeter*

The tables in Appendix 17 are supplied to determine the approximate lengths of perimeters of fires of varying areas and shapes. The original table was worked up by Region 1, and a check with conditions in Region 5 shows it is applicable with reasonable accuracy here.

The first column of the table, headed "Area," shows areas in the units being used, *viz.*, square feet, square chains, or square miles. If square chains are used to express the area, the perimeter in the remaining columns is in chains, if square feet are used the perimeter is shown in feet, etc. Acres must be converted to square chains or square feet to permit use of this table. The three columns to the right of the area column show perimeter corresponding to the area shown by three classes—

*First* perimeter column shows the minimum perimeter possible for the area, that of a circle of the same area. It would represent a fire in which the spread was uniform in all directions. *Third* perimeter column represents twice the minimum shown in column 1 and gives the perimeter for fires which are long and narrow or which finger out. From field and statistical checks this appears to be a satisfactory figure. *Second* perimeter column represents the probable perimeter one-half way between the maximum and the minimum for the specified area. The figures in this column are applicable to the fire of average shape which is neither circular nor extremely elongated.

## **APPRAISAL OF LINE LOCATION JOB, BASED ON PROBABLE LOCATION OF FIRE, AND AS A BASIS FOR MOBILIZATION**

### **The Base Map**

The appraisal of probable behavior of the fire results in estimated locations of the fire perimeter at given hours. This is best indicated on a map, which should also show:

1. Topography.
2. Cover.
3. Roads, trails, firebreaks, clear rights-of-way, etc.
4. Natural barriers.
5. Possible fire camp sites.

### **Elements of First Plan of Line Location**

Elements to take into account:

#### *Barriers*

Use of barriers, artificial or natural, that fire is estimated to reach or approach in any event, such as slides, canyons, grazed-off meadows, recent burns, firebreaks, cleared rights-of-way, etc.

### *First Sectors*

Sectors of Fire that must be attacked first and directly to halt spread (a) into high-value areas, (b) into types more difficult to build and hold line in (higher resistance to control), (c) into new topographic areas (crossing canyon, getting into new major drainage, etc.).

### *Direct Attack Sectors*

Direct attack on other sectors where speed of line construction, shortness and directness of lines, probable ability to hold lines, or tie-in to sectors selected under 1 and 2 made such location best.

### *Indirect Attack Sectors*

Backing off from fire to location selected.

- a. To shorten line materially, as in case of a fire with many fingers.
- b. To make line construction more rapid, as in edge of timber, instead of through dense brushfield.
- c. To avoid areas where steepness of country makes holding a direct attack line doubtful, such as foot of slope instead of face of slope.
- d. To keep out of cover in which large crews cannot be spread out to work effectively, such as very dense brushfields.

### *Delayed Attack Sectors*

Sectors that may be ignored in first attack, such as creeping duff fire that can be caught later without difficulty.

The fire boss' map should show the location chosen for all lines, and order of attack planned on different sectors. If second lines of defense are to be started concurrently, their location for these must also be chosen.

## **APPRAISAL OF LINE CONSTRUCTION JOB**

The fire boss' map shows first location of lines needed to corral fire.

### **Elements in Estimating True Construction Job**

#### *1. Line Production*

Estimate separately for each important type involved in planned location of line the production (line construction only) per man-hour. The usual basis is linear distance in chains and tenths. This can be done directly in lighter fuel types, such as grass, needles, duff, etc., but in heavy fuel types, such as brush, the width of clearing must be considered. In such types, the basic unit is square feet of clearing per man-hour. This should be converted to linear distance, depending on planned width of line, which may vary from ten to sixty feet.

NOTE: Available information will be analyzed, and results furnished for later inclusion in the Handbook.

In estimating production per man-hour, take account of:



- a. Barriers, where *line construction* job is small or absent: such as fire lines ready for backfiring, slides, cliffs, recent burns, etc. Job may be heavy for backfiring, mop-up, etc., but not for construction.
- b. Whether large crews can be spread to work effectively, as in open-cover types; or whether they cannot be spread, and speed of crew will depend on small pilot crew, as in very dense brush.
- c. Time of day as influencing efficiency of labor; such as reduction of output on very hot day, or at night when working under artificial light.
- d. Whether men are fresh or tired at start of shift.
- e. Quality of labor: whether organized crews of experienced, seasoned men; or unorganized, pick-up crews or labor that will have to be closely supervised to avoid loafing.
- f. Topography as influencing pace of work, whether gentle or moderately smooth slopes, or steep rough slopes.
- g. Cumulative fatigue during shift; whether heat, climbing up and down hill, or heavy work, will result in reducing output per hour.

Following is an illustration of the effects of items "c" to "g" above. Assume that on a firebreak construction job the output was 100 square feet per man-hour. The firebreak was built by an experienced and seasoned crew, day work only.

Reductions in output for a similar line built under fire conditions might be:

|   |     |
|---|-----|
| 1. For night work.....                          | 20% |
| 2. Men somewhat fatigued at start.....          | 10% |
| 3. Unorganized—but good men—will work.....      | 25% |
| 4. Steeper, rougher country than firebreak..... | 5%  |
| 5. Cumulative fatigue from long shifts.....     | 15% |
| <hr/>   |     |
| Total.....                                      | 75% |

This is an extreme example—not a recommended basis for actual calculation—but illustrates the need for considering the factors listed in estimating man-hours required for fire line construction.

## 2. *Line Holding*

In addition to the actual construction of lines, calculations of manpower requirements must be made for the line-holding job during the active line-building period.

- a. For backfiring.
- b. For mop-up.
- c. For patrol.

In practice, these jobs are handled either :

- a. By progressively dropping off men from the original construction crew. The extent of this drain is known only very generally. Frequently, no doubt, it is not even taken into account in the planning. Studies along this line have been planned. Only on the very lightest jobs, such as in short grass, is there little or no drain of man-power. In other fuel types, it will probably range from 5% to 20% per hour of original crew strength. Very commonly the hourly rate of drain is far in excess of the original estimates.
- b. By planning and organizing special crews, in addition to the line-construction crews. In difficult fuel types it commonly becomes necessary as the job progresses to divert men from line construction, even when such special crews are initially provided.

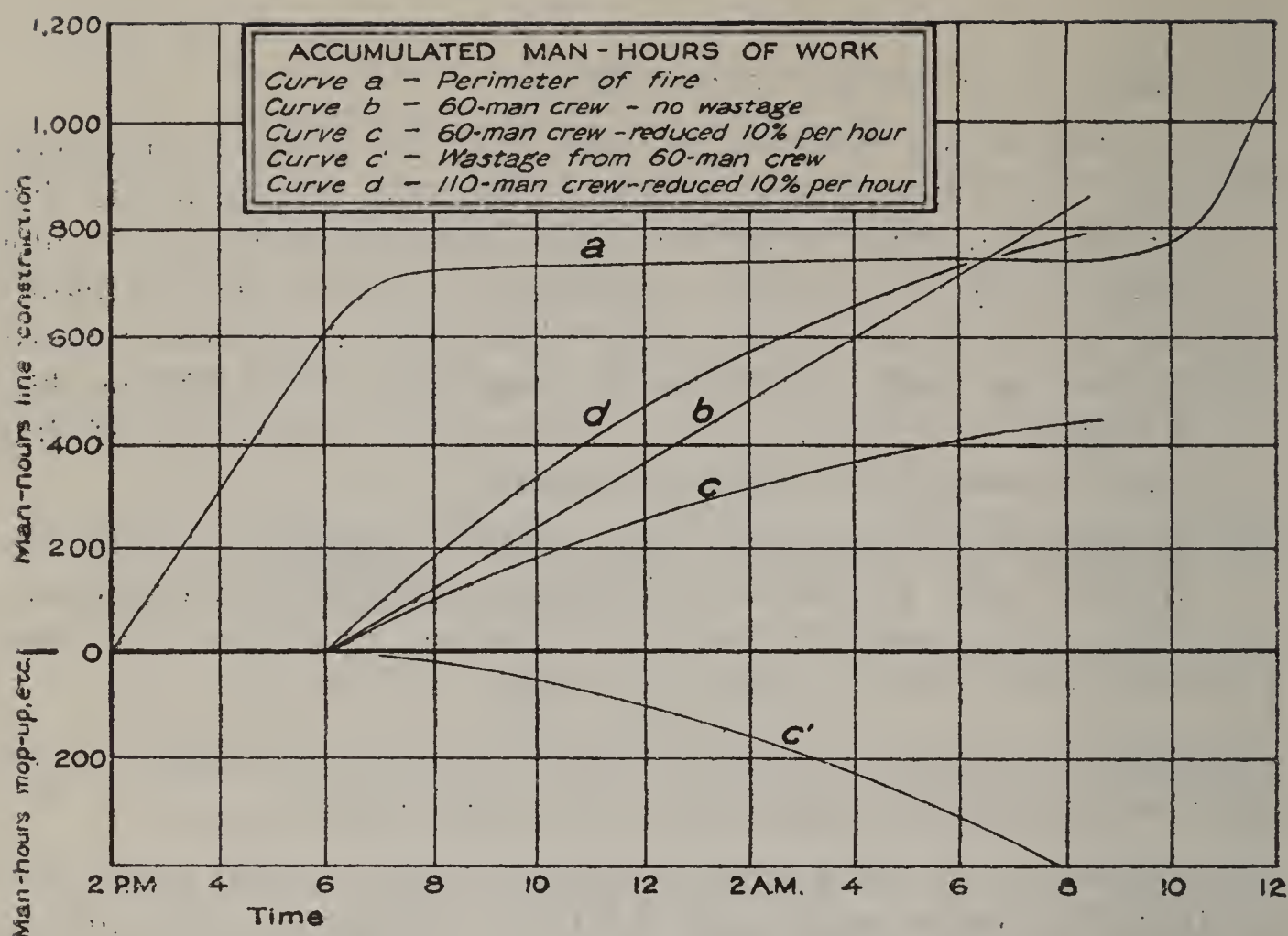
Pending the collection of factual material, all that can be done is to recognize and make specific plans for the line-holding jobs.

The following chart illustrates the wastage factor on a fire which starts at 2:00 P.M., spreads rapidly until 7:00 P.M., levels off without appreciable spread during the night, and picks up again at 9:00 A.M. next morning. On the chart is shown :

- (a) Perimeter of fire at any given hour in man-hours of line construction (curve *a*).
- (b) Accumulated man-hours of work at any hour for a crew of 60 men starting work at 6:00 P.M. and with entire crew continuing on line construction. Note that fire would be surrounded at about 6:30 A.M. (curve *b*).
- (c) Accumulated man-hours of line construction for same crew, but assuming a wastage for mop-up and patrol of 10% per hour. Note that fire would not be corralled during work period (curve *c*).
- (d) Accumulated man-hours of mop-up and patrol of above crew (curve *c*<sup>1</sup>).
- (e) Accumulated man-hours of line construction of a crew of sufficient initial size (110 men) to corral fire during night, with allowance for wastage of 10% per hour (curve *d*).

Line-production calculations showed that 60 men could corral fire by 6:30 A.M., but a consideration of the wastage factors indicated that it would take a crew of 100 men to construct the fire line by 6:30 A.M. This calculation is important in planning man-power needed.





In calculating man-power and overhead requirements, the mental processes include the consideration and decision as to probable needs for each sector and each division of a fire. As an aid to orderly thinking, as a check list, and as the basis for ordering man-power, overhead and special personnel, a suggested work sheet is shown as Appendix 18. Equipment and tools may be included on the same or a similar work sheet.

## PLANNING MOBILIZATION

After the estimates of needed man-power, tools, etc., sector by sector, are made, the detailed plan for mobilization can be prepared. Obviously, the planner always has had in mind what is available as he works on the preliminary problems above discussed. A lot of preliminary work has been done: arranging for crews and leaders; rounding up transportation; getting camp equipment ready to roll, etc. The making of the final mobilization plan, upon which depends first period control, is now in order.

### Elements of Mobilization

The elements to take into account include:

1. The available sources of labor—presumably listed in the Fire Plan charts.
2. Tool and equipment items that will be required in detailed plan of attack. Give particular thought towards getting special equipment, such as trail builders, tanks, etc.

3. The availability of enough competent overhead, including all the kinds required by the type of big fire organization to be used.
4. The availability of all the kinds of transportation that will be needed.

For each of these elements the planner must estimate the number of hours required for the getaway and travel to the camp site selected. The fire map should aid in making accurate estimates of travel time. The readiness to go on short notice must be known. These considerations are particularly important, since calculations of required strength of attack have been based on an estimated hour at which effective strength will be on the lines.

### **Safety Allowances**

Whatever the planner may order done, once first-shift dispatching is completed, second-shift mobilization is not in itself a safety factor for the first shift. Even though second-shift crews are to be moved to and bedded down in fire camps, where they will be available for emergency call during the first shift, their use then will weaken the planned attack for the second shift.

Real safety allowances are increases above planned first-shift attack, and are made:

- a. Because of possible increase in spread of fire over that estimated.
- b. To offset uncertain estimates by the planner.
- c. Because estimated time for completion of control may be very close to the next morning deadline.

Reasonable allowance of extra man-power for any such situation is generally desirable. Not all fires, however, are in the class justifying safety allowances. For example, when the control job is estimated to be completed by midnight, it usually makes no real difference if it is not done until 2:00 or 3:00 A.M. Or, if the special weather forecast is for increasing humidity next day, it goes beyond the bounds of prudence to assume worse conditions ahead. Or, if allowance is simply to ease the mind of the planner, it can hardly be justified.

No detailed rules are possible. Clear recognition is needed that safety allowance is a matter for specific study and decision on each fire.

### **SUMMARY**

The key steps in planning first-shift attack on big fires are:

1. Appraisal, shown on a map, of where fire will be at time full attack is effective. This should take into account the effect on rate of spread of existing dryness of fuel, relative humidity, wind velocity, slope, burning fuel types, barriers and number of hours of spread under approximately existing conditions. Normal behavior charts to determine departure of humidity and wind may be used.



2. Based on probable location of fire, decisions, sector by sector, where to place lines, and the order of importance. This should take into account protection of key areas or high values, use of barriers and reducing size of line-construction job where possible.

3. Estimates, sector by sector, strength of attack required separately for:

a. Line construction.

b. Line holding.

This should take into account loss of output due to fatigue, night work, quality of labor, and of number of hours available for control job.

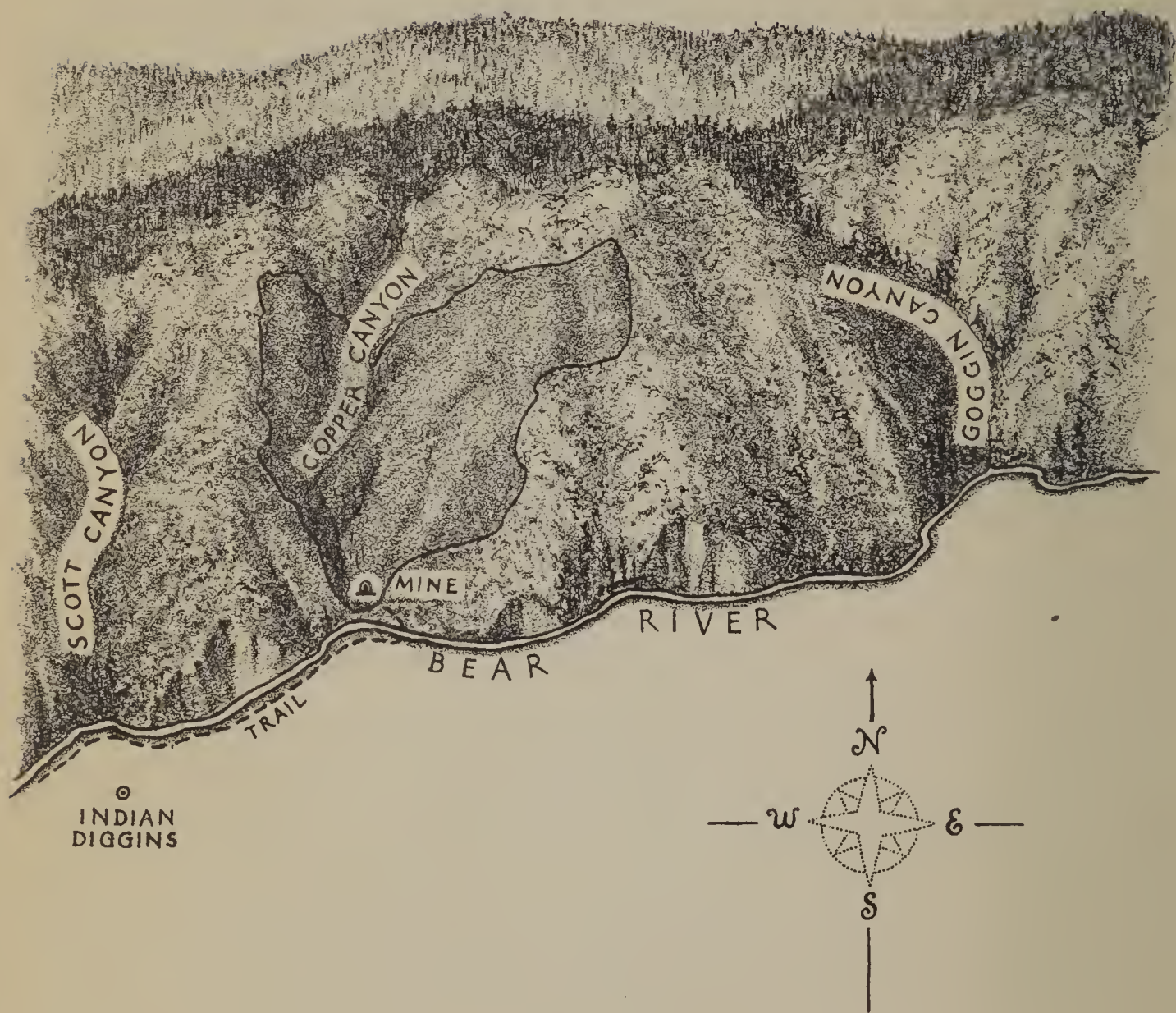
4. Reasonable safety allowances in strength of attack where justified by specific conditions on individual fires.





Problem I

A



# PROBLEMS IN PLANNING ATTACK ON LARGE FIRES

Some of the more common problems in planning attack are illustrated in the following cases, each based on actual fires. The cases are presented both to show the strategy for given situations, and to indicate the processes that must be followed to determine the correct plan of attack on any large fire. Every attempt has been made to emphasize the importance of viewing the job as a whole, forecasting probable fire behavior, making correct selection of lines, and mobilizing sufficient man-power and equipment to do the calculated job of control within the time available.

## **Problem 1: Effect of Cover and Topography on Rate of Spread.**

### *Situation*

Fire discovered at 1:30 P.M., and located at old mine in Copper Canyon above Bear River, which is a large and reasonably straight stream. Probable size at discovery, 2 acres.

Fire Boss sizes up the situation at 3:00 P.M., at which time the fire is about one and one-half miles long and up to one-half mile wide, representing a spread of about 350 acres in one hour. Normal weather conditions.

### *Action required*

#### 1. *Study of Topography*

The slope from the river is steep, up to 60%, and is reasonably smooth. The slope is cut by several sharp ravines, and by Scott, Copper, and Goggins Canyons—all gulches of considerable size, particularly Goggins, which is deep and rough. About one mile in an air line north of the river the general slope becomes more gentle, and in about two miles from the river culminates in a broad, smooth ridge. The total rise from the river to the top of the ridge is approximately 2,000 feet. Beyond the ridge at a distance of about one mile is a second ridge of similar character. The two ridges are separated by a shallow canyon about 400 feet deep. The two ridges merge at the hill near point A. (See sketch.)

#### 2. *Study of Cover*

The cover on the river slope is grass and open brush, with occasional oaks on the ridges and conifers in the gulches. The cover on the ridge is an average stand of ponderosa pine with an understory of scattered reproduction and with clumps of poles, black oaks, and manzanita, becoming greater in density across the ridge on the north slope. Under the timber there is a ground cover of needles, and in the more open spaces, bear clover.

The edge of the timber belt is about one and one-half miles from the



river. The strip of timber on the south side of the ridge is about one-half mile wide. The cover north of the ridge is unbroken timber.

### 3. *Estimate of Rate of Spread*

If cover and slope conditions were uniformly the same as on the area already covered by the fire, the expectation would be a fire length of at least five miles and a fire width of possibly two miles by 6:00 P.M. This would project the fire beyond the second ridge and across both Scott and Goggins Canyons, making a fire of around 5,000 acres. Even under normal weather conditions, spread would continue (but at a reduced rate) during the night. Control lines might involve taking in ten to fifteen thousand acres with a perimeter of from fifteen to twenty miles.

a. *Effect of topography.* However, it is calculated that the rate of spread of the fire, other conditions being equal, will decrease sharply with reductions in slope. The Fire Boss estimates in this case that it would take at least one and one-half hours for the fire to reach the top of the ridge, assuming no change in cover. He notes the ravines on the slope, which are already reducing the angle of the normal fan shape of the fire, and are thereby tending to narrow the front in relation to length.

b. *Effect of cover.* Also, as the fire gets into the pine type, it will crown but rarely; and rate of spread will be reduced materially in the pine needle and bear clover cover. Adding this effect to the effect of reduction in slope, the Fire Boss figures that the fire will not reach the top of the ridge before 6:00 to 7:00 P.M. Its night spread beyond the top of the ridge will be slow and can be handled by direct attack. The side spread is not likely to go beyond Scott Canyon on the west and the ridge west of Goggins Canyon on the east.

### 4. *Plan of Attack*

The major sectors are handled in the following order:

a. *Rear Sector.* The Fire Boss already has a crew of ten men on the way to Indian Diggins, via trail, which he proposes will patrol Bear River to guard against spot fires and to clean burn the river slope during the night. Backfires will not be advanced beyond natural side spread of the fire.

b. *Front Sector.* The plan is to construct and backfire a line along or near the top of the ridge, picking as open country as possible and following edge of fire at those places where it may slop over ridge. Advance crews will be sent ahead to work on any fingers that may threaten to spread well beyond the ridge top.

c. *Flank Sectors*. Fire lines will be put down each side and back-fired, starting these lines far enough outside the advance of the fire to guard against flanking by the fire. These lines can be built rapidly and safely.

Completion of river backfiring will be done after flank backfires are brought to the river.

d. *Lines*. Needed lines are estimated to be one mile along ridge, two and one-quarter miles on each flank, and one and one-half miles along river, a total of seven miles, inclosing an area of approximately 1,500 acres.

#### *Summary of Correct Practices*

1. No panic on account of rapid initial rate of spread.
2. Effect of topography carefully considered.
3. Effect of change in cover carefully estimated.
4. Logical plan of attack is made, with correct sequence in handling the various sectors.
5. Lines are selected for ease and safety of construction and for safe holding next day.



## Problem 2: Use of Weather Predictions.

### *Situation*

Second week in October. At 2:00 P.M., second day of dry, hard, east wind, fire starts in bottom of canyon, blows up and makes run of 3,000 acres on both sides of canyon. Fire edge part way up slopes on both sides of canyon and near main ridge at head of canyon.

Cover moderate mixed brush. Slopes moderate. Soil with little rock, except in scattered outcrops. Medium litter under brush.

Wind has died down by 5:00 P.M., and fire spreading slowly.

### *Man-power and facilities available*

Four CCC camps, leaders, transportation, tools, and equipment available. Truck trail along main ridge. Good trails down side ridges. Road up canyon to point one mile above start of fire. Trail from there to head. Good access to head and rear of fire, and flanks accessible by dropping down from trails or climbing up through burn from canyon.

### *Weather Prediction A*

Sharp increase in relative humidity during night; cloudy and high relative humidity next day. Wind down-canyon and gentle during night, continuing same direction but increasing velocity next day.

This means that during night fire will die down, flaring in spots; but large part of edge going out, with rest smoldering. Next day fire will probably be more active, but will not run on large scale.

### *Possible Plans of Attack*

Key point is (1) whether to backfire entire canyon from truck trail and ridge trails, or (2) make direct attack by hotspotting and coldtrailing.

With the fire quiet during night it is fairly safe to drop men from trails through medium brush to edge of fire.

Considering weather outlook it is doubtful whether backfires would take hold.

Men can be spread out to attack edge in any desired number of places.

Even if not all of edge worked first night, favorable conditions next day will make continuation of direct attack safe and possible. Medium brush means relatively easy for men to work line and not too much work to be put in per unit of line.

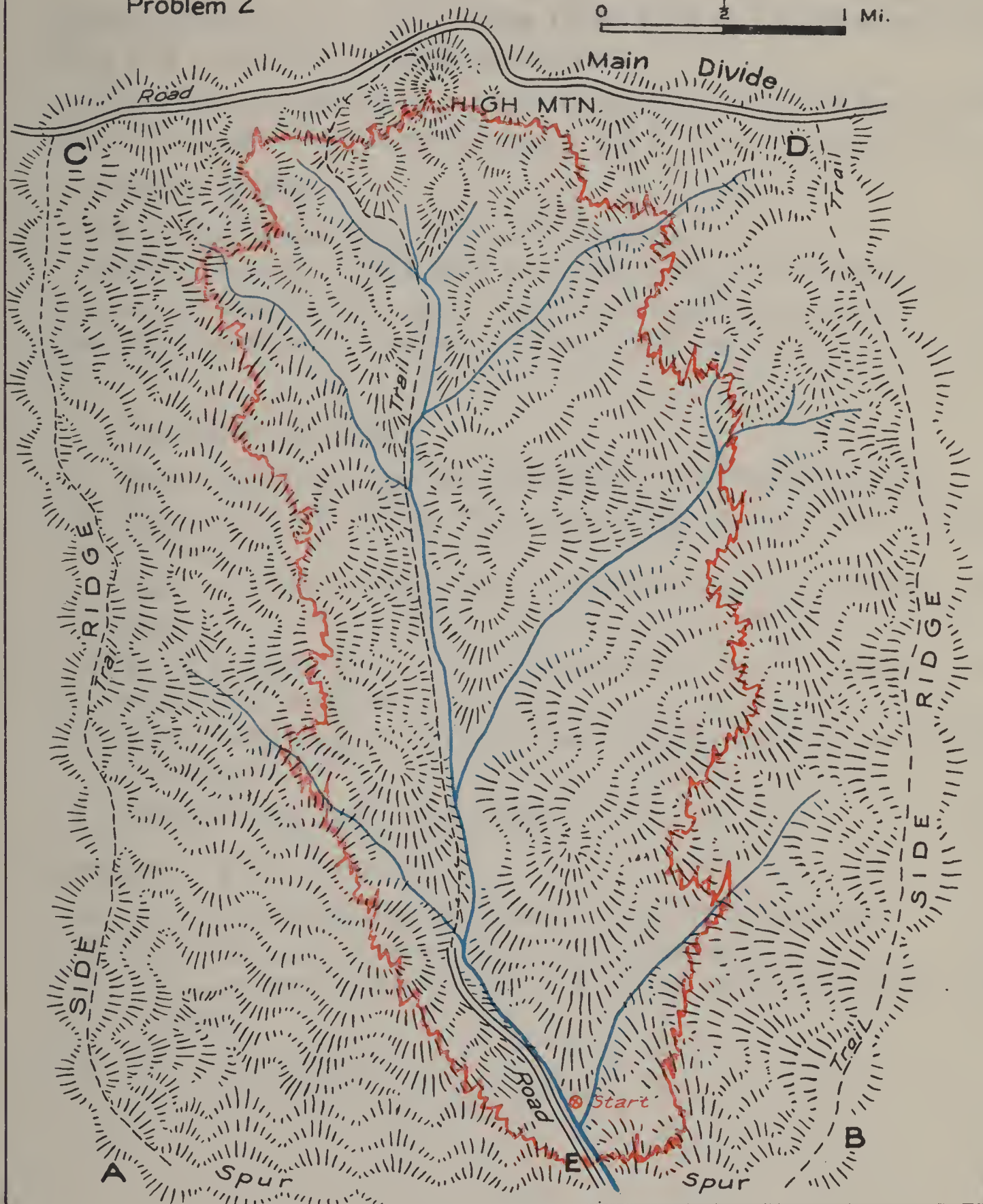
*Decision:* to coldtrail.

### *Organization of Attack*

1. Start crews in both directions from High Mountain at head of fire.
2. Start crews from road in both directions on rear and lower flanks of fire.

Problem 2

0  $\frac{1}{2}$  1 Mi.







3. Take other crews to head of road up canyon, walk them up trail, and progressively send them through burn to both flanks.
4. All crews to have designated sectors.

### *Weather Prediction B*

Decreasing wind velocity during night, but same up-canyon wind. Relative humidity up to 35% during night. Next day relative humidity 20 to 25% ; wind 12 to 15 miles per hour.

This means fire will remain active during night, except in lee of spur ridges. Burning will be somewhat spotty, but it will not be a quiet fire.

### *Plan of Attack*

Coldtrailing impossible—line too hot to work.

*Decision:* to drop back to road and ridge trails, and backfire out entire canyon, selecting side spurs from both ridges down which to construct backfire lines into canyon to connect with lines on the rear of the fire.

### *Organization of Attack*

1. Start backfiring crews both directions from High Mountain.
2. Start line construction crews from points A and B down spurs into canyon.
3. Start crews down ridges from C and D to prepare trails for backfiring.
4. When backfires reach trail intersections at C and D, continue down ridges with backfires.
5. Follow with mop-up crews so that backfiring may proceed as fast as possible.
6. Backfire lines A-E and B-E last.

### *Summary of Correct Practices*

1. With quiet fire during night, use direct coldtrailing attack.
2. With active fire at night, drop back and backfire.
3. Use of weather prediction is key factor in determining basic plan of attack.
4. Plan job as a whole.
5. Time operations on various sectors.



### **Problem 3: Shortening Lines to Insure Prompt Control**

#### *Situation*

Middle of September. Fire started 1:00 P.M. at end of road in main Redondo Creek, was lost in first attack, and driven by moderate wind and with relative humidity 12% made seven-mile run up both sides of canyon.

Cover on north slope into Redondo dense brush and live oak, with heavy duff. Side canyons, such as Bear, Lion, Panther, and Deer, have steep gradients, very steep canyon walls. Spur ridges between them are sharp and steep.

Cover on south slopes, north of Redondo, is mostly grass with scattered brush patches, heavily grazed, and fire will die out as soon as wind drops. Only hotspotting on fire edge and patrol will be needed in this area.

Main ridge south boundary of Redondo drainage is bold, sharp, and rocky. Difference in elevation from river to ridge from 3,000 to 3,500 feet. Several deep saddles in ridge at heads of side canyons.

Cover along ridge is patchy, but is continuous except on rock outcrops. Scattered snags and down logs are dangerous hosts for sparks.

Cover on south slope of main ridge is heavy mixed brush, and highly inflammable.

#### *Probable Behavior of Fire*

During run of fire from 4:00 P.M. Ranger figured it would reach sharp open spur to east of Howard Gulch and head would die down there. Figured fire would approach ridge A-B, but would not cross it. Figured fire would not come near ridge from B south and east but would form very irregular line about half-way up main north slope, with numerous fingers and bays. Fire would, in general, pull up main slope from east to west, being higher in Bear and Lion Canyons than in Deer, Panther and Rock Creeks.

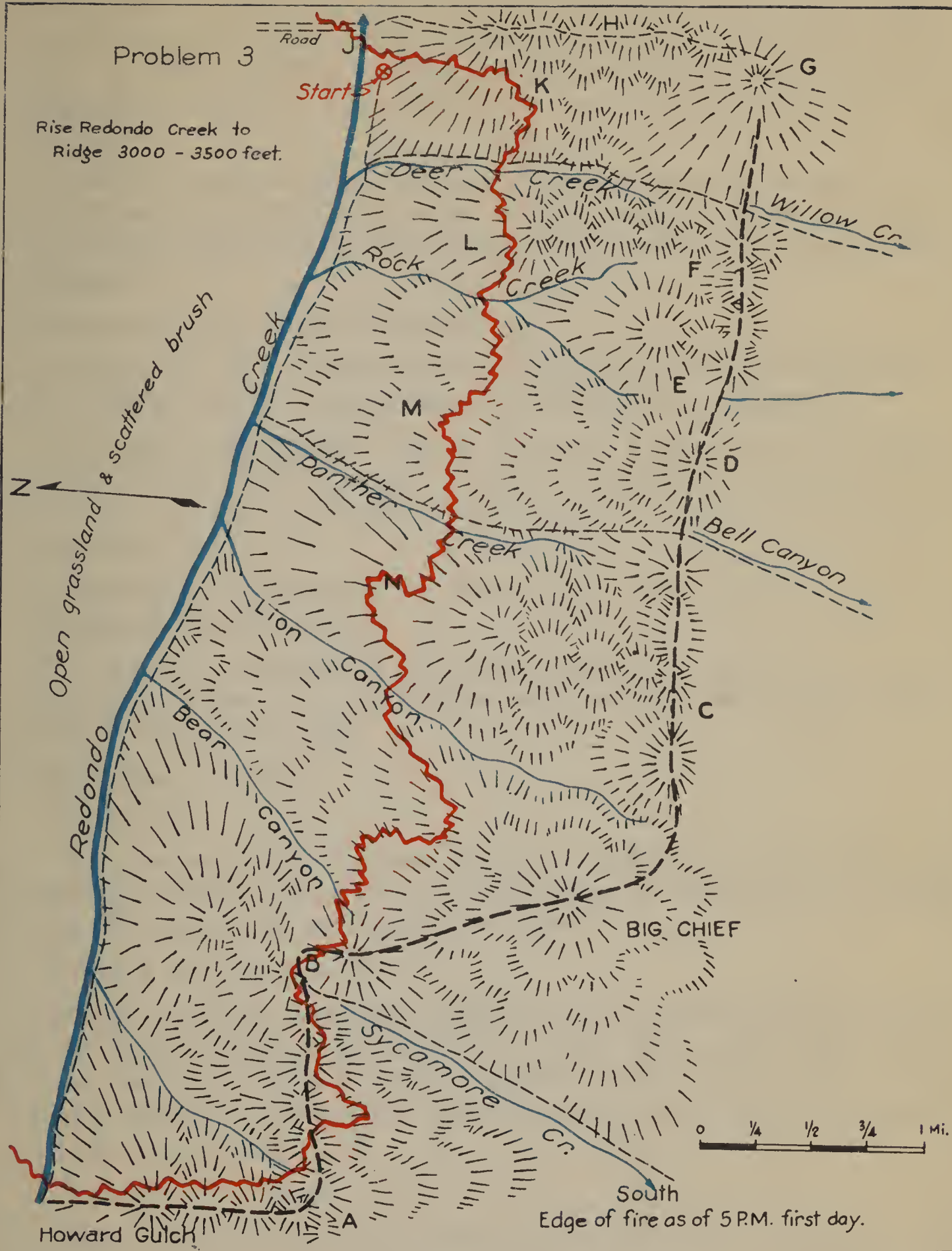
Figured that trail in Redondo would be open by about 7:00 P.M. when fire cooled down.

Weather prediction was for sharp drop in wind velocity between 5:00 and 6:00 P.M. and for rise in relative humidity to 45%. Prediction for next day for decrease in wind velocity to not over seven miles per hour, and for relative humidity to fall not lower than 25%; wind the normal up-canyon direction.

These changes meant that for the first night, south edge of fire would die down, smoldering in heavy duff and flaring up and making short

Problem 3

Rise Redondo Creek to  
Ridge 3000 - 3500 feet.







runs in spots. These runs would increase the irregularity and length of the fire edge.

For the next day, no major blowup of the whole south edge of fire was expected; but runs would be made and the fire would work up the slope, probably reaching the main ridge in places on narrow fronts; particularly dangerous at heads of Bear and Lion Canyons during late afternoon.

Probably most dangerous point on ridge next day will be saddle and flat ridge at head of Bear Canyon, where up-canyon draft will throw fire directly against ridge. Other possible runs will hit main ridge more obliquely.

#### *Man-power and Facilities Available*

Three CCC camps with 400 men available, with tools, transportation, etc. Outside labor in organized crews available up to 200 men.

No roads to main ridge. Trail up Redondo. Roads part way up Bell, Sycamore, and Willow Canyons, leaving four-mile walk up each by trail to main ridge. Narrow trails down Deer and Panther Creeks through dense cover.

Firebreak along entire main ridge—forty feet wide—has not been maintained for three years.

Pack stock available to service about 300 men at camps on or near main ridge. Water in several places near heads of side canyons, short distance below main ridge.

#### *Initial Plan of Attack*

##### *West Line*

From main ridge at A down Howard Gulch ridge to Redondo. No particular problem: light cover; a coldtrailing or hotspotting job. Small crew of selected men can handle first night.

##### *South Line from A to B*

Since fire will be at or near ridge, plan is to establish camp near head of Sycamore Creek or in saddle, clean strip along south edge of firebreak and catch fire as it comes to break or backfire out. Safe to work men on break; and this sector has no bearing on plan for other sectors. Should be done first night.

##### *Lines North of River*

Open grass country, heavily grazed and at this time of year fire will die down, leaving only hotspotting job. Guard, foreman, and fifteen-man road crew in that country will handle. This is not a major problem, so it is not discussed in detail.



### *East Line*

Fire has not crossed spur ridge just to east of point of origin. A good, recently maintained trail up this ridge. Cover grass and open and patchy brush. Crew can be landed by truck at foot of trail, and coldtrail fire's edge. Crew can be strung out and can complete job by morning, probably to point K.

### *Main South Line*

The rough estimate is that the actual edge of the fire from B to K is fourteen miles, with probably spots outside of main burn. Because of generally heavy cover and duff, all or nearly all of edge would have to be worked.

Crews could be sent by truck to J, walked up Deer and Panther Creek trails and could work both ways. But only small crews can operate because of heavy cover. Lines could probably be completed only from K to L and from M to N by next morning, since crews could not get on line before 9:00 P.M.

Rock, Lion and Bear Canyons are so rocky and impenetrable that even selected crews would not reach the fire edge until after midnight, and would then be too tired to have any chance to tie up the ragged lines before the next burning period.

To reach the main ridge from the south is a climb up good trails in Bell and Willow Canyons and a fair trail in Sycamore built to reach the firebreak, of perhaps 2,500 vertical feet. Pack stock will handle tools, food and equipment. Can land men, rest them, and get them at work on lines by from 9:00 to 10:00 P.M. The length of the ridge firebreak from B to G is nine miles.

It is decided to use the main ridge firebreak as base of attack, and attempt no work on sidehill line B-K.

### *Order of Starting Work on Main Ridge Sectors*

1. Send first crews with pack stock, tools, grub, and camp equipment up Sycamore Creek, with camp to be established near the summit:
  - a. Small crew of selected men with knapsacks to take Howard Gulch ridge sector, starting at A and staying until controlled to Redondo Canyon.
  - b. Crew to take sector A-B, cleaning out and backfiring, picking up possible spots and slopovers. Use least effective men on this sector.
  - c. Larger crew sent to top of Big Chief to clean strip in firebreak and carry backfire toward saddle at head of Bear Canyon.

- d. Smaller crew to start from B, cleaning strip in firebreak to saddle at head of Bear Canyon and backfiring from B down to saddle when crew above is about halfway to Bear Canyon saddle. These crews may have to start fires away from break to run up at them unless firing from break is effective.
2. Crews with tools, food and camp equipment on pack animals sent up Bell Canyon trail. Camp will be established at head of canyon.
  - a. Most effective men will start from top of Big Chief cleaning strip in break and backfiring south and east toward Lion Canyon saddle.
  - b. Crew starts from low peak at C cleaning and backfiring toward the same saddle, timing backfires to reach saddle at same time as backfire of crew from Big Chief working toward them.
  - c. Crews to clean strip in break, but not backfire from Bell Canyon saddle to saddle at E.  
 (The lines of action under 1 and 2 will be completed by about 10:00 o'clock next morning, and designated backfires burned in far enough to hold if main fire in Bear or Lion Canyons blows up, as is probable. Down-canyon winds will help backfires first night and early morning. This is the work that has to be done before burnnig conditions next day.)
3. Crews sent up Willow Creek with tools, grub, stock, camp equipment, etc.
  - a. Clean strip in break but do not backfire from Willow Creek saddle to E.
  - b. Crew to clean, but not backfire from Willow Creek to G.
  - c. Crew to clean and, if necessary, widen trail G-H and select easiest route and construct backfire line from H-K.

### *Plan for Second Day Attack*

Unless forced, do no backfiring east of C. Keep strong enough crew on line to handle any threats that may come along this front and to backfire if occasion requires.

### *Plan for Second Night Attack*

1. Start crews at G and F backfiring to reach Willow Creek saddle at same time.
2. When this is completed, or nearly so, start crew backfiring line G H K.
3. When G-F backfire well started, start crews from F and D backfiring to reach saddle E at same time.



4. Start crew at a slightly later time than step 3, backfiring from C and D to reach Bell Canyon saddle at same time.

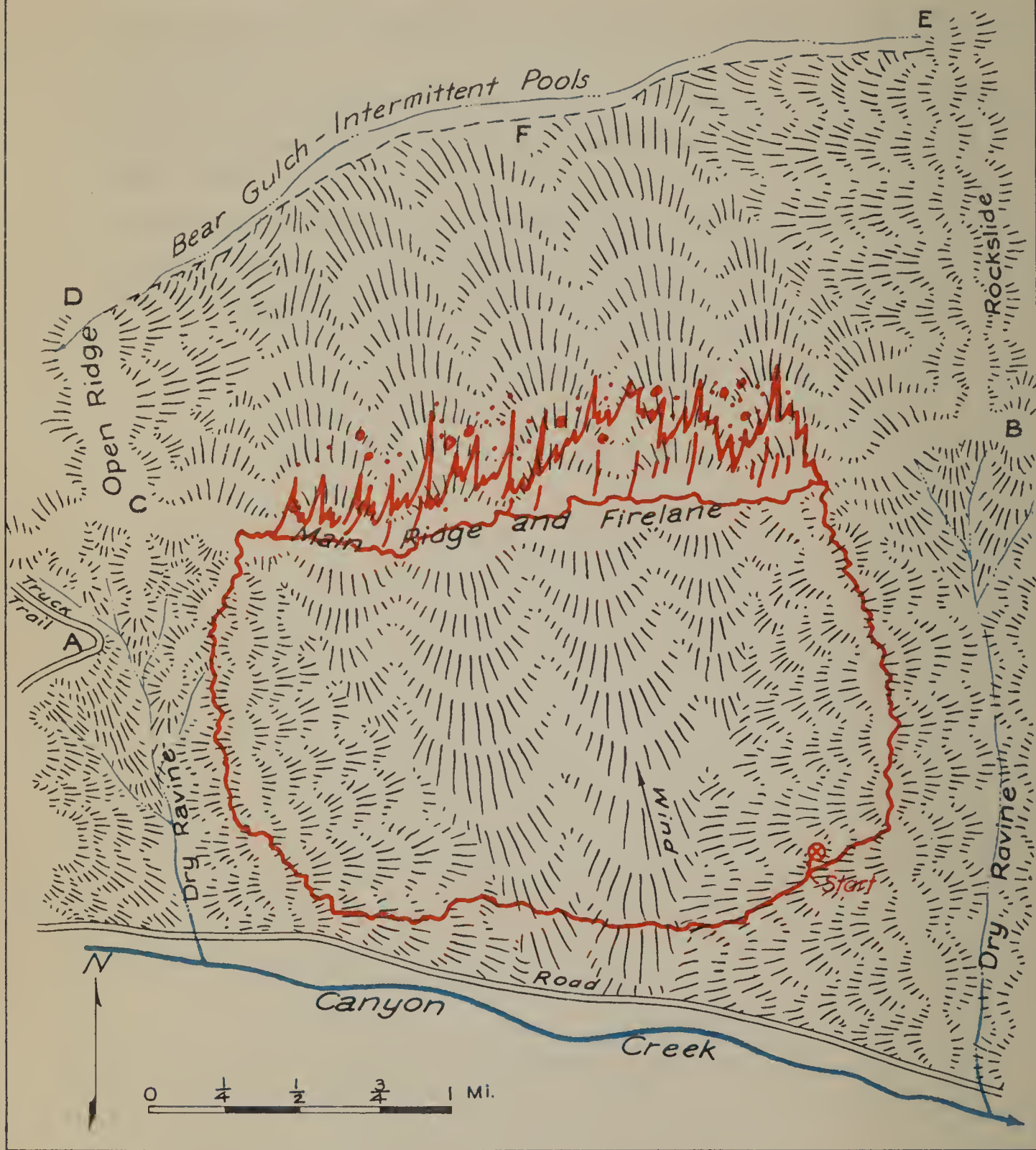
#### *Summary of Correct Practices*

1. Calculating size of whole job.
2. Recognizing impossibility of coldtrailing line on slope, because number of men that could be worked inadequate to do job in one work period.
3. Concentrating on holding main ridge and accepting loss of entire north slope.
4. Backfiring at once sectors which fire will probably reach next day.
5. Handling backfiring only as fast as needed to protect line against main fire.
6. Backfiring simultaneously from peaks to intervening saddles.
7. Preparing lines for backfiring in advance of need.
8. Coldtrailing flank lines where that method can be effective.





Problem 4



## Problem 4: Recognizing When to Backfire.

### *Situation*

Fire started 2:00 P.M., in mid-September, foot of steep (65-70%) south slope. Wind twelve miles per hour up-slope; relative humidity 17%. Cover of slope, medium dense mixed brush; grass and scattered brush at foot of slope. Vertical rise from foot of slope to ridge 1,500 to 2,200 feet. Fire lost on first attack; spread rapidly up-slope. Fire lane (8 feet wide) along ridge; too narrow to put men in front of fire.

### *Size-Up of Fire Behavior*

With at least four hours to run, the fire on a front of from five-eighths to three-quarters of a mile will reach ridge crest; will spot and flare over and become established on north slope. This slope has very heavy cover of live oak, scattering spruce, some snags, and heavy duff ground cover, with an occasional more open ridge. By evening, fire will be in spots and stringers on north slope.

Fire on south slope will spread in width along contour of slope, but will not reach rocky gulches near two flanks.

Night weather conditions: predicted rise in relative humidity to 40%; wind velocity decreasing, and switch in direction to down-canyon. This means that after about 8:00 P.M. fire on north slope will burn only in spots. On south slope, fire backing down into rocky gulches will die down and move very slowly.

By about 7:00 P.M. south slope will be burned out and cooled down so men can safely work along main ridge to fire lane through fire.

Lots of rolling material on north slope. Ground largely rocky and difficult in which to build clean line.

### *Man-Power and Facilities Available*

Four CCC camps and competent overhead for all. Tools, equipment, trucks, and tankers available.

Truck trail taps west gulch near west edge of fire at point A, three-fifths of way to top. From this point men can readily reach fire lane along ridge. Another truck trail crosses the main ridge about one mile east of B. From this point it is quite a climb to reach B on the main ridge.

Trail along or just above sharp, rocky gulch at foot of north slope, usable by pack stock. Will require one and one-half to two hours to walk and pack in upstream to point E on gulch directly down slope from east edge of fire on main ridge.



## *Line Location Problem*

### *South Line of Fire*

By placing tankers and men, can kill fire as it works down slope to road and stream. This is plan decided on.

### *East Line on Main South Slope*

Can work both ways on this line by starting crews at top and in Canyon Creek clearing ravine and either backfiring or catching fire as it backs or rolls into ravine. This is plan decided on.

### *West Line on Main South Slope*

Can handle same as east line, landing men at Point A, and also working crew up from bottom. This is plan decided on.

### *North Line*

Can get access to main ridge and spots and stringers on upper north slopes by landing men at Point A, walking them to fire lane and thence along main front of fire and down to spots and stringers. Can put men in by about 7:00 P.M. Can get men into gulch at foot of north slope by 5:00 P.M.

Very unlikely, or practically impossible to hold spots and stringers on upper north slope. Too steep and too much rolling material, and too hard to clean lines.

Ranger decides to dispatch crews to start as early as possible to clean out and prepare for backfiring the gulch at foot of north slope, since fears loss of entire slope is inevitable; and problem is to select best time for necessary backfiring jobs.

As soon as men can get safely in on main ridge, decides to start crew of selected men to work on north slope spots and stringers. Has no idea that this will control fire on upper slope, but will hold about where it is now and give ample time for crew to get gulch ready for backfiring and backfire at selected time. Fears that with down-slope wind, spot fires may build up into large fire and cross gulch by spotting, or drive crews out or force premature backfiring with grave danger of losing gulch and side lines.

East and west lines on north slope are no particular problem. The east line consists of continuous rocky slides which can be held by backfiring from top down while open ridge on the west line runs into Bear Gulch. Since these backfiring jobs have to be done before backfiring gulch, and since the natural barrier of open ridge could be spotted across if major fire builds up on north slope, it is imperative to check north slope first for at least one shift.

## *Order of Starting Work on Sectors*

1. Start south line soon as possible to prevent crossing road and stream to new area.
2. Soon as possible start working up gulches from south line, on east and west lines on south slope, to hold them.
3. Soon as possible start crews on cleaning out gulch to be used for final north line.
4. By 5:00 or 6:00 P.M., or earlier if safe, start crews working east and west lines both up and down the ravines.
5. By 7:00 P.M., or soon as safe, start crews on spots and stringers on upper north slope.
6. At same time, start select crews down both flanks of the sidelines on north slopes to do needed cleaning jobs preparatory to backfiring.

## *Timing of Backfires in Initial Plan*

### *1. During First Shift.*

Fire ravines on east and west flanks, south slope, and south line. To make sure of holding fire before tackling north slope, thus avoiding danger of flanking one or both north slope side lines.

### *2. Second or Third Shift.*

After control of entire south slope assured, and after Bear Gulch and the side lines on the north slope are ready for backfiring, and a final survey shows the ragged edge on the north slope is not being controlled by coldtrailing, remove men from north slope. Select time and start from point B on ridge head of east line, carry backfire down to point E, junction of east and north lines; thence down gulch toward point D. At about time backfiring reaches point E, start backfiring from point C toward point D. This should be completed by time crew working from point E reaches about point F. Then finish from point D to point F.

## *Summary of Correct Practices and Pitfalls Avoided*

1. Appraising fire behavior. Recognizing that it will become established on north slope. Avoiding futility and danger to men of frontal attack from narrow lane. If there is a firebreak along main ridge, insuring safety of men, then initial attack should try to hold fire at firebreak.
2. Recognizing that once fire established on north slope, entire slope would eventually be lost. Avoiding acceptance of blind hope that spots and stringers can be held when experience proves the contrary.

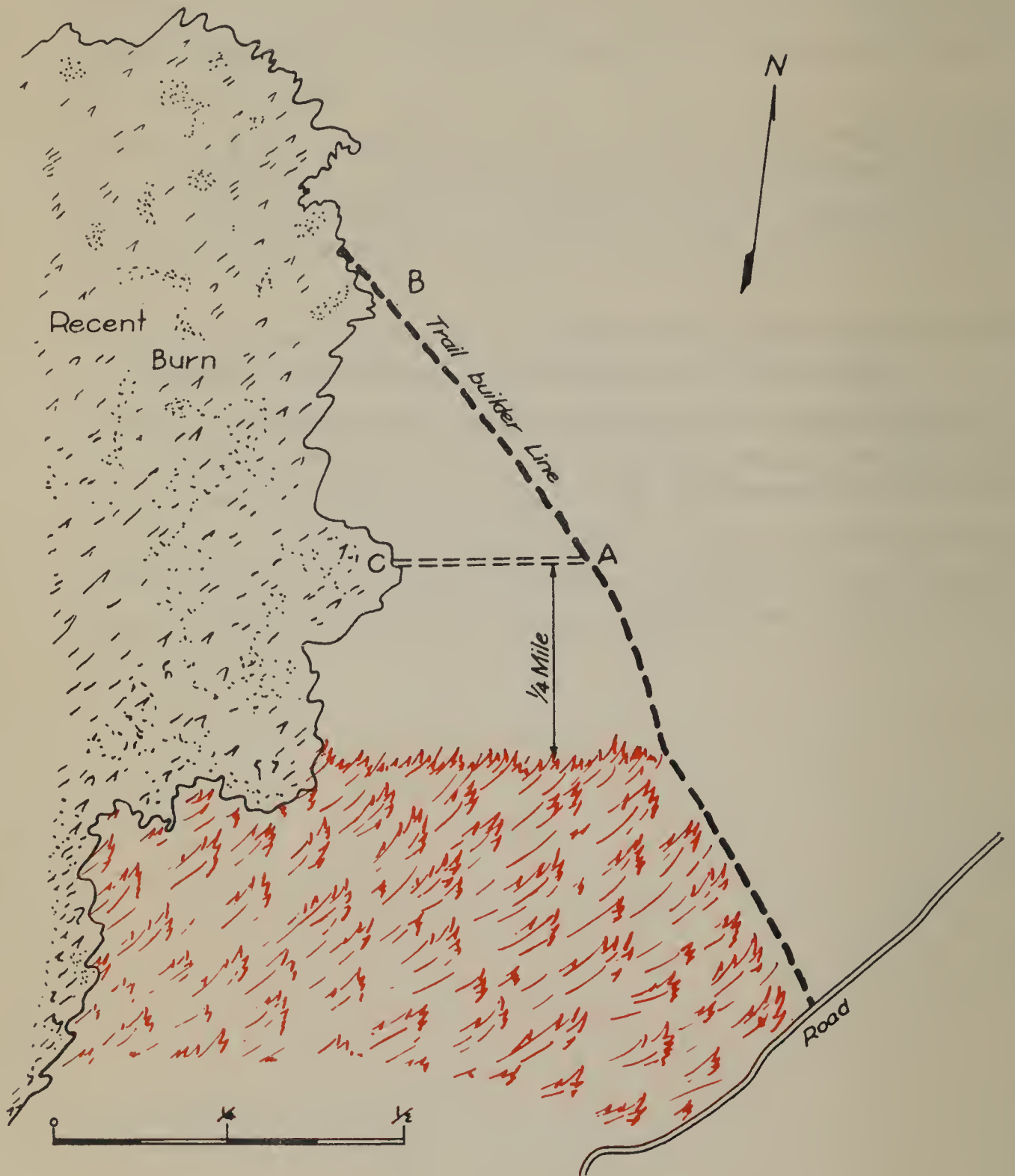


3. Recognizing that key point on fire is handling of entire north side as a whole. Avoiding limited view of situation, or being blinded by existing hot situation on south side which can be handled.
4. Recognizing that handling of north side has to be planned for and work started at same time as for south side. Avoiding temptation to let north side go until south side control assured.
5. Recognizing that time to build needed eventual backfire lines on north side and timing of backfiring will take more than one and perhaps three shifts. Avoiding premature and hasty final attack before fully ready.
6. Recognizing that established spots on north slope must be held and prevented from building up a head, to assure time for work planned under paragraph 5. Avoiding careless assumption that spots are of no consequence since whole north slope is to be back-fired.
7. Timing work on sectors in accordance with whole plan. Avoiding piecemeal attack based on expediencies of the moment.
8. Holding north side until danger of flanking from south side gone; then selecting favorable time for backfiring, and planning back-firing to minimize dangers of lost line. Avoid unnecessary gambles.
9. Playing safe. If by chance direct attack on spots succeeds, that fact will be determined before backfiring operations on north side are begun. Avoiding premature setting of backfire when not crowded for time.





# Problem 5



## **Problem 5: Locating Lines Oblique to Fire Axis.**

### *Situation*

Medium density brush field on gentle slope. Recent burns as shown on sketch. Fire advancing from the south on an even front. Trailbuilder line being built along east flank of fire, and being backfired a little in advance of the head of main fire. Line completed to point A, one-quarter mile ahead of front of fire.

### *Action required*

The trailbuilder line is continued from A toward B, rather than cutting across shorter distance to point C on edge of recent burn. This location will keep fire from coming up to the entire line at one time.

Impact at any one time will be over a relatively short section, thus facilitating catching spot fires, making possible the doing of work at the front of the fire, using less men, and providing safety for the men. Line A-B can more surely be held, whereas A-C undoubtedly would be lost.



## **Problem 6: Direct or Indirect Attack and Need for Second Line of Defense.**

### *Situation*

Fire has started at noon in late September and has spread over a large territory during the afternoon, crossing firebreak on ridge from point B to a little south of point C. By late afternoon the fire is scattered over Gomez Canyon, as shown on sketch. The area in this drainage is estimated at 800 acres. The wind has lowered and the fire is spreading slowly and is expected to smolder only during the night, except where rolling has taken place and small fires are burning uphill.

The cover is medium to heavy chaparral and the topography is rough and steep. The difference in elevation between Lompoc River and ridge A-C is 1,800 feet. The slopes drop abruptly to Lompoc River, and the canyon is narrow.

The wind has been fresh, dropping to gentle in the evening. Relative humidity at 1:00 P.M. was 14%. Forecast for tomorrow is for somewhat higher relative humidity and lighter wind, but no marked change of weather conditions.

There is a firebreak along the main ridge A-D, and a lateral break on ridge C-H. There is a narrow lane or trail on ridge A-P. There is no trail along Lompoc River, but it is passable on foot at a rate of about one and one-half miles per hour.

The country south of Lompoc River is a steep, chaparral-covered range with no firebreaks and few trails. The access for large crews is difficult, involving several hours' trail travel.

Watershed values are high in the Lompoc drainage.

Men can be brought in to points B and C over the firebreak system, with about one hour's walk from nearest truck trails.

### *Action required*

It will be assumed that the portion of the fire west of firebreak A-D can be controlled, with control lines connecting with points B and C. This problem is to determine the plan of attack in Gomez Canyon, aiming at first night control, but with second line of defense in case attack fails in whole or in part. Keeping fire from crossing Lompoc River is the most important consideration in order to avoid a long, expensive campaign, with heavy watershed losses.

The most obvious plan of attack is to catch up the slopover at the head of Sanchez Creek; to backfire firebreak C-H; to widen lane on ridge A-P; and to backfire it; and to backfire river. Some of the drawbacks of this plan are:

Problem 6



Fire edge  
at 4 P.M.





1. Great amount of ridge backfiring necessary ( $2\frac{1}{2}$  miles from E to H and  $1\frac{1}{2}$  miles from A to P), which is a difficult and slow job at night.
2. One and one-half miles of widening to do on lane A-P.
3. Extreme dangers in backfiring 4 miles of Lompoc River, with its many twists and steep banks.
4. Inclusion of salient G-H-J in fire lines, involving  $2\frac{1}{2}$  miles of line to backfire and hold, when main fire has not reached it, nor is likely to reach it during night. This disadvantage can be offset by cutting and backfiring either line G-J or F-K.

For the above reasons, direct attack by coldtrailing is considered next.

The principal disadvantages are:

1. Long length of undercut line (probably 3 miles of such line between E and O).
2. Rough terrain on river slopes.
3. Generally heavier cover than on ridges.

The principal advantages are:

1. No threat to area east of river if attack is successful.
2. Topography such that coldtrailing is possible although difficult.
3. Certainty, if plan is successful, of first night control.
4. Possibility in this case of making the attack from several points, such as from E, M, N, and O, by taking crews down lanes and through the burn.
5. Favorable night weather expected.

The decision is to make the direct attack. The controlling reason is the safety it affords against the fire jumping the river. Another is that attack can be made at several points simultaneously, otherwise the chances of success would be remote. In fact, direct attack from points E and O only would be useless, since two crews, however large, could not possibly complete the job during the night period.

The factors against success are the possibility of flareups during the night, leading to lost line, and the difficulty of making a safe undercut line in rugged country. The real danger is on the line above the river between E and O.

It is judged that, if direct attack fails, it will be necessary to fire the river, probably doing this the second evening, unless conditions are unusually favorable during the second day.

The plan of attack for the first night is summarized as follows:

a. *Direct attack.*

1. Coldtrail slopover in head of Sanchez Creek with small crews working from either end. 10 chains.



2. Start coldtrailing at E into Gomez Canyon. 40 chains.
3. Start two crews at M coldtrailing in both directions. 40 chains and 30 chains.
4. Start two crews at N coldtrailing in both directions. 30 chains and 20 chains.
5. Start two crews at O coldtrailing in both directions. 20 chains. and 40 chains.
6. Start crew near B coldtrailing toward crew from O. 25 chains.

*b. Safety measures.*

1. Widen lane from O to P and prepare for backfiring. 30 chains.
2. Construct a line from a point on firebreak C-H to a point on river. Ridge F-K is considered too near the main fire to allow for possible spread in case of failure of the direct attack, so G-J is selected.
3. Prepare river for backfiring by cleaning out or isolating piles of debris at the mouth of the canyon. This work is planned to start at daylight; all other work at 6:30 P.M.

The following illustrates proper use of second defense lines:

*Situation*

Crews working out of M and N have difficulty all night, and at 2:00 A.M. fire rolls into steep canyons nearly to river. Small segments of fire run up under the line from rolling burning material. It becomes clear that much of the line between O and main Gomez Canyon cannot be completed during the night work period, and possibly cannot be held at all. Crew from E has good coldtrail to point L in canyon. Crews from B to O succeed in completing a similar job on that line.

*Action required*

1. Start backfiring line O-P from the top, completing as soon as construction is completed at 6:00 A.M.
2. Clean out Gomez Canyon from L to K but do not backfire.
3. Plan to have crews along river during the next day, allowing fire to burn down. Clean burn or backfire the remaining strips along the river, including lower end of Gomez Canyon, late the next afternoon or early evening, depending upon the weather. Do not wait longer than necessary.
4. Complete cutting of G-J, but do not backfire unless the fire gets away on line E-L or in Gomez Canyon.

*Summary of Correct Practices*

1. Sizes up situation as a whole.
2. Determines what sectors can be handled independently of main plan, and what methods to employ (lines E-L and B-O).

3. Selects method with least possible threat of catastrophe and promising quickest control.
4. Carefully plans simultaneous attacks at all accessible points.
5. Starts second line of defense preparations.
6. Recognizes promptly failure of direct attack and backfires one line before morning.
7. Takes advantage of the success of a portion of the direct attack and ties this portion of the line to the final line along the river by the most practicable direct route.
8. Allows fire to back down to river rather than to set a wholesale backfire, even if this means that control is postponed until the second evening.



## Problem 7: Type of Line Needed and Number of Men Required.

### *Situation*

#### *1. General Conditions on Fire*

A large fire burning in late afternoon in early August. Brisk southwest wind. Considering cover, topography and forecasted night weather conditions, it is expected to spatter itself over Iron Canyon (see sketch) but not to get beyond the eastern edge of the Iron Canyon watershed during the night. Probable position of fire edge by 8:00 P.M. is shown on sketch, with little night spread expected after that time. One possible danger point is the small saddle at point "S" on sketch.

General plan of control includes crews working in Cold Creek, the backfiring of firebreak from point A past point C, and the construction and backfiring of line A-B from firebreak to Cold Creek. The subsequent discussion will cover line A-B only.

#### *2. Cover and topography*

The cover on ridge A-B is chaparral from four to six feet tall and of medium density (penetration difficult but some thin spots on steeper and rockier portions of ridge) except in vicinity of saddle, where cover averages seven feet high and is very dense for about ten chains.

The ridge is fairly sharp except at the saddle and at the lower end near point B. The grade of the ridge varies from 0% to 60%, and the use of machinery is not practicable.

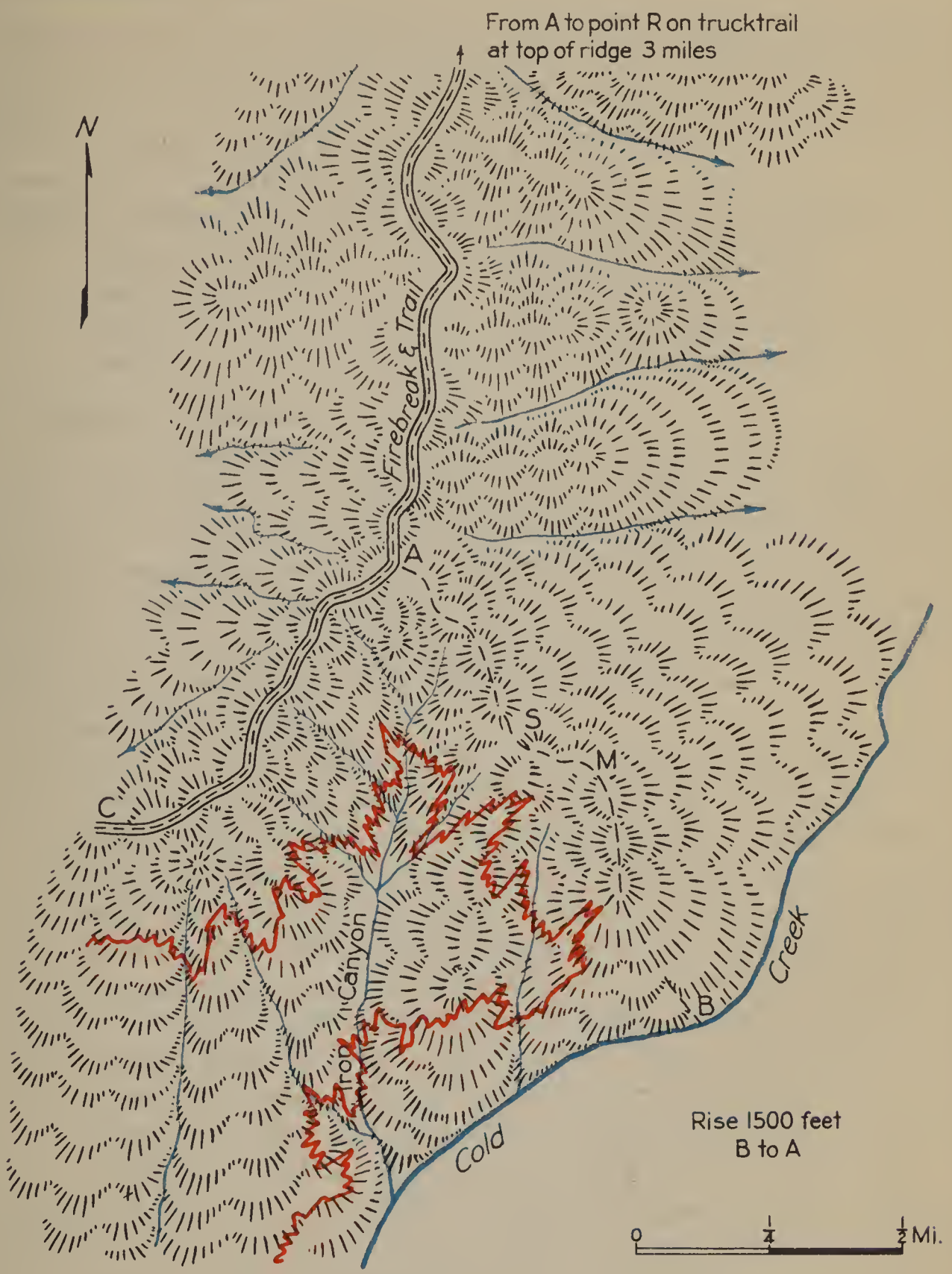
The total length of line A-B is 90 chains, and point B is approximately 1,500 feet below point A in elevation.

#### *3. Conditions Governing Access, Time of Beginning of Work, Etc.*

Men can be trucked to point R on truck trail, after eating, to arrive by 6:30 P.M. It is three miles over an undulating firebreak from point R to point A. It will take crews one and one-half hours to make this trip, carrying tools and canteens, including a short rest after arrival. Pack service has been planned to bring to point A supplemental supply of water, extra cutting tools, backfiring fuel, midnight lunches, and communication equipment.

Access to point B is by one and one-half hours' walk over a canyon trail, with some danger to men en route from rolling rocks, snags, etc. Backfiring cannot start from bottom, as men cutting from point B would have no refuge in case of sudden runs by the fire. It is necessary to start backfiring on line A-B as early as possible, not only to insure completion of the job by morning, but also to allow backfiring of firebreak A-C (which should start simultaneously with that on line A-B) to get under way. The saddle at point S should be safeguarded as early as possible, which can be handled better by starting from A. For these reasons, all forces will assemble at point A. Safety to men assembling at point A is not a problem.

Problem 7







## *Solution of Problem*

### *1. Backfiring*

Backfiring of line A-B should lag behind line construction by about ten chains until point M beyond the saddle is reached, after which time it can be pushed closer.

Backfiring should be completed by 5:00 A.M. to allow for burning out of lower end of line and Cold Creek reasonably well by 6:00 A.M., and completely by 8:00 A. M. The distribution of relief patrol crew will be effective at lower end of line at about 6:00 A.M. Men will be taken out by lower trail if conditions along trail are safe.

The time elements for *Night Crews* are summarized as follows:

|                        |                        |
|------------------------|------------------------|
| Line construction..... | 8:00 P.M. to 4:30 A.M. |
| Backfiring .....       | 9:00 P.M. to 5:00 A.M. |
| Mop-up .....           | 9:00 P.M. to 6:00 A.M. |
| Patrol .....           | 9:00 P.M. to 6:00 A.M. |

### *2. Character of Line*

In cover as described, on a fairly sharp ridge, and with a light but favorable wind expected, the width necessary is judged to be eighteen feet, except for ten chains in the vicinity of the saddle, where a width of thirty-five feet will be needed. In certain short sections of the line it may be safe to skimp the above widths. The line should be cleared to mineral soil for an average width of from three to four feet. The line will hug the east side of the ridge to the extent practicable.

### *3. Man-Power Needed*

- a. *Line Cutting.* Under the cover conditions described, it is estimated that a reasonably fresh man can cut and dispose of 120 square feet of brush per hour. A line eighteen feet wide contains 1,188 square feet per chain. It, therefore, requires approximately ten man-hours to clear a chain of line. This estimate is applicable to 80 chains of the line only. On ten chains of fire line the man-hour production is estimated to be but 60 square feet on account of greater height and density of the brush, and the greater disposal problem due to additional width of line. The expected production for the double width requires forty man-hours per chain. The man-hours required becomes 800 for 80 chains, and 400 for 10 chains, or 1,200 for the entire job.

Practically all the work will have to be performed at night, and toward morning the crew will be tired, even after a planned one-hour rest during the midnight lunch period. The necessity of having to work under poor light is estimated to reduce output 10%. The rest period reduces output 1 hour out of 8½, or 11%. The fatigue factor is estimated to reduce output 40% toward the end of the job, and the average effect is estimated at 15%. The above estimate of total man-hours required,



corrected for rest period, darkness and fatigue, becomes 1,600.

- b. Scraping a three-foot trail to mineral soil is estimated to require 0.8 man-hours per chain—the total requirement is 72 man-hours.
- c. The actual backfiring crew needed consists of six men—three with torches, and three lighting auxiliary fires below the back-fire line.
- d. The crew attending backfiring to dirt down if necessary, to catch spot fires, and for preliminary mop-up is estimated at 20 men.
- e. The patrol will be left behind as firing proceeds, with a moving up of some of the men as the fire burns away to a safe distance. The maximum number will be strung out as the backfiring comes to an end, and is estimated to be 40 men. The average is estimated at 25 men.
- f. The task of distributing water, lunches, torch fuel, etc., is estimated to require the services of a crew increasing to 15 men by morning, with an average of 10.
- g. Summary of man-power:

|                                    | Time excluding<br>rest period<br>hours | Man-hours | Average<br>number of<br>men |
|------------------------------------|--|-----------|-----------------------------|
| Line cleaning .....                | 7½                                     | 1,600     | 213                         |
| Line scraping .....                | 7½                                     | 72        | 10                          |
| Backfiring .....                   | 7                                      | 42        | 6                           |
| Mop-up .....                       | 9                                      | 180       | 20                          |
| Patrol .....                       | 9                                      | 225       | 25                          |
| SOS .....                          | 9                                      | 90        | 10                          |
| Total .....                        |  | 2,209     | 284                         |
| Percentage for line construction.. |  |           | 78%                         |
| Percentage for other work.....     |  |           | 22%                         |

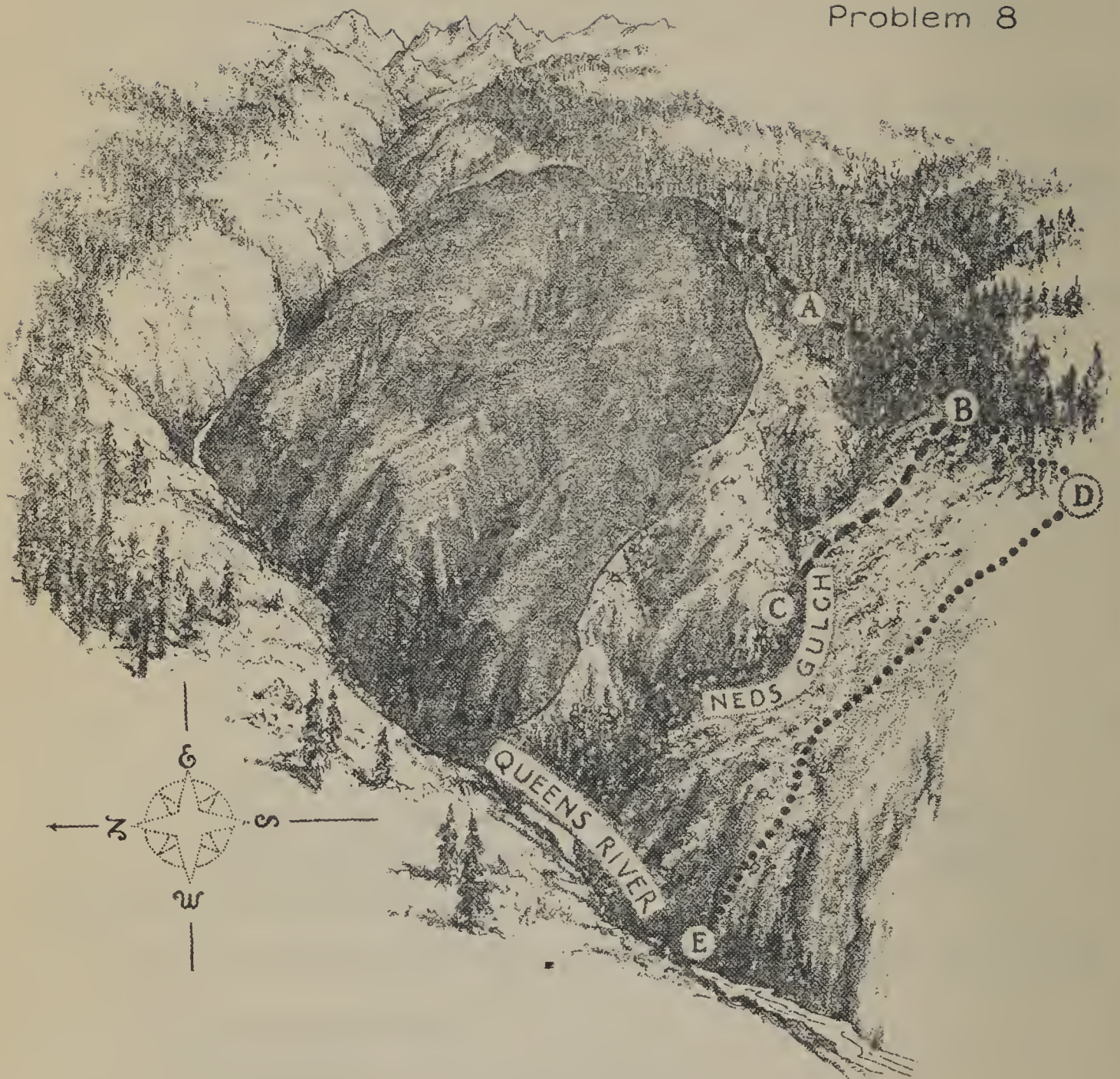
### *Summary of Correct Practices*

1. Careful estimate of the line construction job is made by considering:
  - a. Character of cover.
  - b. Unit output.
  - c. Additional size of job due to situation in saddle.
  - d. Lack of effectiveness of labor because of certain evaluated factors.
  - e. Auxiliary jobs of backfiring, mop-up, patrol, and line service separately.
  - f. Importance of completion of job by early morning, rather than at latest possible hour.
  - g. Sequence of jobs and correlation with adjoining sectors.





Problem 8





## Problem 8: Guarding Against Flanking of Lines.

### *Situation*

A large fire has started during late August on the south bank of Queens River and has burned to the top of the slope to the south on a wide front. The fire has been controlled along the river and on the east flank. A control line has been brought westward along the high ridge south of the river to point A, but has not yet been advanced beyond and above the westward spread of the fire at 5:00 P.M. The west flank is open, as indicated on the sketch.

The cover is grass and scattered brush and oak on the lower slopes, and ponderosa pine and mixed coniferous timber on the upper slopes and on top of the broad ridge south of the river.

The slopes are steep, ranging up to 60% near the river.

Weather conditions include a moderate southwest wind and normally low relative humidity of 18% at 1:00 P.M.

Rested men are available at the main fire camp on top of the ridge. The small crew available out of a spike camp at the mouth of Ned's Gulch is worn out and will be used on the easy job along the river. No men from this camp will be available for major control operations.

### *Action required*

The normal plan of attack is to continue construction of line westerly from A, backfiring as built, and to cut a line to the river to prevent spread along the slope, together with whatever attention the river line demands. The essential consideration is to avoid having the line to the river flanked by the fire and thus having to do the job over again. Two solutions are possible:

- a. Send a good-sized crew down to the river to work up along the edge of the fire, holding it on the lower end at or east of Ned's Gulch, with a clear understanding of the point aimed for by the crew working down from the ridge. Such a plan would mean building line A-B and then line B-C, since upper end of Ned's Gulch would have been burned out, and backfiring line as built, with bottom crew working up along Ned's Gulch.
- b. Extend line A-B along the ridge far enough beyond the fire to insure completion of top line and flank line to canyon before fire can reach the proposed location. Such a plan would involve construction of line A-D, then line D-E, backfiring as built.

In the particular situation described in this problem, line A-D ( $1\frac{1}{4}$  miles) and line D-E ( $1\frac{1}{2}$  miles) were built and backfired by midnight. The lower end of the river line was then backfired, and



the fire was controlled. If a fresh crew had been available at E, and if Ned's Gulch had been more open, solution (a) above might have been tried with equal success. In this case, however, solution (b) was favored, since line construction from D to E was easy and could be initiated promptly. Safe ridge lines that could surely be held would result, and supervision and correlation of effort were simplified. The uncertainty of sending a strange crew with strange overhead into Ned's Gulch, and the more difficult line to construct and hold, were eliminated. This more than offset the additional length of line A-D over A-B.

### *Summary of Correct Practices*

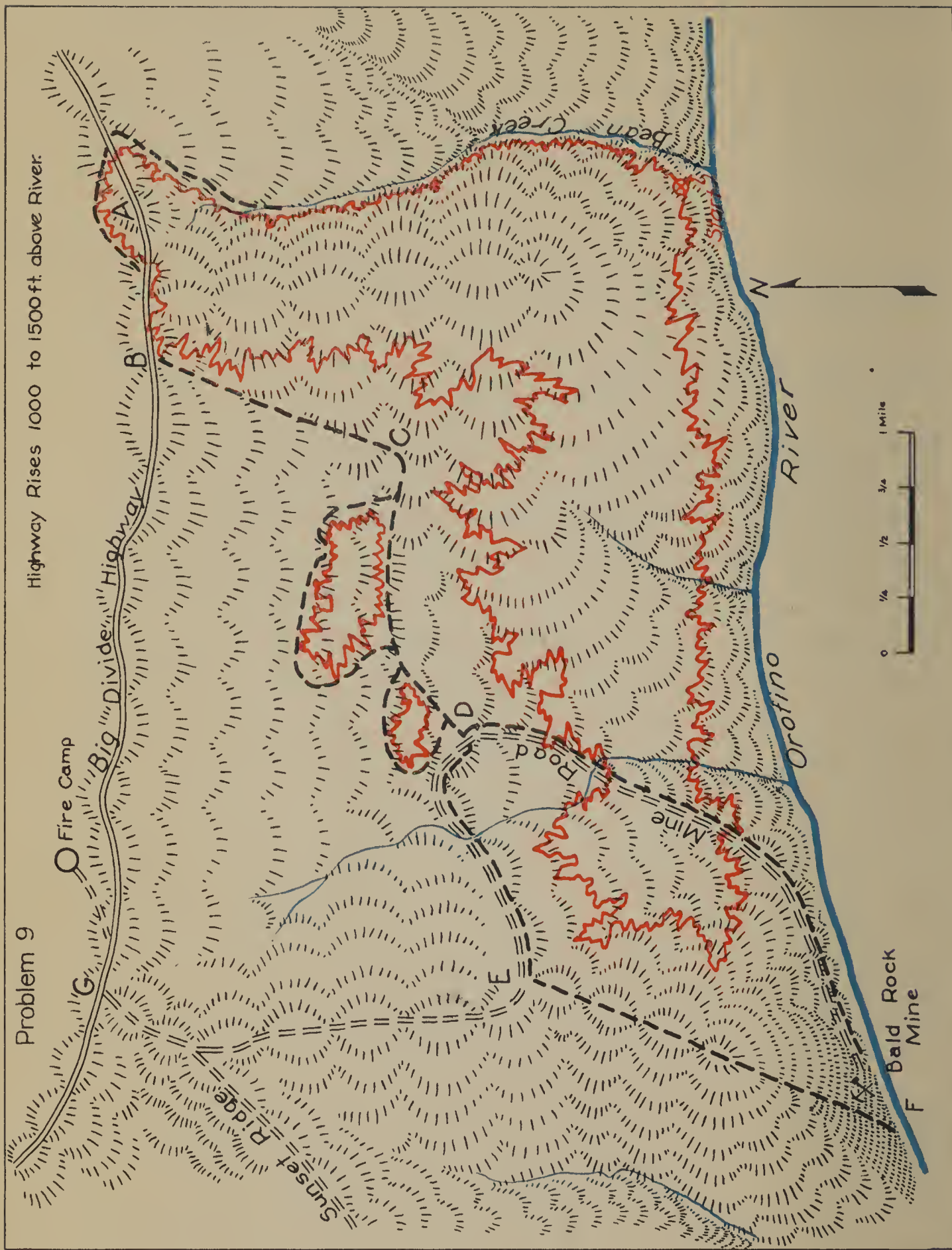
1. Proper planning in line location guarded against flanking of the line.
2. Selection of lines favored routes of easiest and most rapid construction, with greatest sureness of holding.
3. Relatively small additional area of low value included by line A-D (grass and scattered brush on slope) was given consideration but no great weight in selecting location of lines.
4. Lines were selected to simplify supervision and reduce possibilities of uncorrelated action.
5. Tired men were not depended upon to handle critical sector of the line.





Problem 9

Highway Rises 1000 to 1500 ft. above River.



## **Problem 9: Staying With the Fire in Face of Apparent Disaster.**

### *Situation*

A fire has started at 12:30 P.M. in the middle of October on north side of Orofino River just west of mouth of Bean Creek.

Burning conditions had been unusually bad for the time of year. No rain has yet fallen except light showers in late September, and north and east winds had added to the normal season-end dryness of the fuels.

On the day of the fire there was little wind, and relative humidity was high in the morning. At about noon the wind became fresh and gusty, switching back and forth from southeast to northeast. Relative humidity at 1:00 P.M. was 12%. The weather forecast was for continuation of the same general conditions, but with prospect of a decided change for the better within thirty-six hours.

Orofino Canyon has extremely steep slopes covered with scattered brush and timber reaching 1,000 to 1,500 feet in elevation above the river. From this rim the general slope back to the main ridge to the north is gentle.

Tributary canyons, such as Bean Creek, come down from the main divide every two to three miles. These canyons are steep, but not particularly rocky or broken.

The divide to the north is about two and one-half miles from the river. A State highway follows the divide closely. A dirt road, very steep at the lower end, leads down to the Bald Rock Mine. A branch dirt road extends southwesterly down Sunset Ridge for several miles. The distance from the saddle at the head of Bean Creek to the road junction (A to G on sketch) is three and one-half miles.

The first run of the fire, before a gusty wind, was northerly up the west side of Bean Creek. Cliffs above the point of origin helped to narrow the initial front. The first crew of ten men arrived at point A at 12:50 P.M., and went down Bean Creek. They held the fire as it backed down the slope and worked back toward the divide on the east flank of the fire.

At 3:00 P.M. the fire had reached the highway at point A, and was spotting across. By this time substantial suppression forces were at hand, and during lulls in the wind caught and held the spots. The final line in this vicinity is shown on the sketch. The fire was held along the highway to a point near B. At 5:00 P.M. the wind subsided somewhat, relative humidity rose, and a line was started southwesterly from point B, paralleling the edge of the fire at some distance, and backfired.

Around 2:30 or 3:00 P.M. the fire gained momentum on the steep



river slope and swept westward at great speed, and scattered fire all along the river slope and edge of the rim. The full force of the east wind carried the fire beyond the Bald Rock Mine road by 4:00 P.M.

By the time the lull came, at 5:00 P.M., the fire was established on the slope and had burned well onto the gentle timber slopes. The outline was as shown in red on the sketch.

### *Action Required*

The general plan of attack was made after reports by scouts, and by 7:00 P.M. all sectors (except the river, where there was no danger of crossing) were manned and work was started. One crew continued line B-C; a second started from D toward C along the line selected and marked during the scouting; a third started to backfire the Mine road from E to D; and a fourth started to construct and backfire a line from E toward the Bald Rock Mine, keeping a little over on the lee or west side of the ridge.

Around 8:00 P.M. the wind revived somewhat, becoming gusty and tricky, and spot fires were numerous. By 2:00 A.M., however, all lines had been constructed and backfired except line E-F, which had not yet quite reached the barren slides above the river. At this time the wind rose sharply and numerous spot fires began to occur on the sectors between B and E. All spots were caught until about 2:30 A.M., when the fire got away in several places on sector D-C, and within a few minutes had burned several acres, as shown on sketch.

Conditions were very bad, and it appeared to the Sector Boss on C-D that the fire was away to a big run; that both lines B-C and E-D would be flanked, and that an entirely new plan of attack would be necessary next day. Instead of taking his crews to camp, however, as one of his leaders suggested, he told his crew leaders to collect their men at safe places in the burn inside the line and to rest until further orders. He, himself, sat down and took a smoke.

At 3:15 A. M. the wind began to die down, and then within a short time all crown fires dropped to the ground and spread became relatively slow. As these conditions began to be apparent, the Sector Boss sent his best crew leader to observe the situation on line B-C, and he, himself, scouted toward point D. There he met the night line inspector, who reported line D-E as being held. He immediately started his crews working around the breaks from both directions. Soon the crew leader returned from line B-C and reported that this sector seemed to be holding. Confirmed in his belief that no flanking dangers from the other sectors existed, he pushed his crews hard, and by 5:00 A.M. had the breaks corralled.

At 6:00 A.M. the wind again began to blow hard from the east, and considerable trouble was had with spot fires. These were all caught, however. The wind again lessened at 8:30 A.M. If the breaks had not been corralled, this morning blow of 2½ hours would have taken the fire to the highway and possibly across Sunset Ridge.

Conditions were quiet during the rest of the forenoon. The relief, mop-up and patrol crews were able to get the fire in good condition and hold it during the afternoon blows.

### *Summary of Correct Practices*

1. Sector Boss, despite alarming situation,
  - a. Did not become panic stricken.
  - b. Kept his men in position to attack if conditions changed for the better.
2. Sector Boss kept in mind the safety of his men.
3. Contact was maintained with adjacent sectors.
4. Men were rested when no productive work could be done.
5. Changeable nature of wind was recognized.

In this case, observance of these practices made first-night corral possible and saved many hundred acres of valuable timber.



## Problem 10: Stages in Planning Attack on First Period Fire.

### *Situation*

1. Fire discovered at 3:00 P.M. early in September.
2. Wind brisk from southeast. Relative humidity 12% at 1:00 P.M.
3. Cover: Open stand ponderosa pine on flat at mouth of Monroe Creek. Cover varies from dense manzanita to scattered ponderosa pine, with many snags and medium ground understory of manzanita and small reproduction. On ridges at higher elevations more open ponderosa pine, but with many scattered dense patches of reproduction and manzanita. Dry grass along ravine bottoms and in occasional openings in other cover. Approximate rise in elevation from bottom to top, 1,500 feet.
4. Monroe Creek dry except for pools at lower flat. Twelve-place Forest Service camp ground on flat. Smith River shallow, with gravel wash between river and highway, making a barrier about 400 feet wide.
5. Topography as indicated on attached sketch.

### *Preliminary Action Taken*

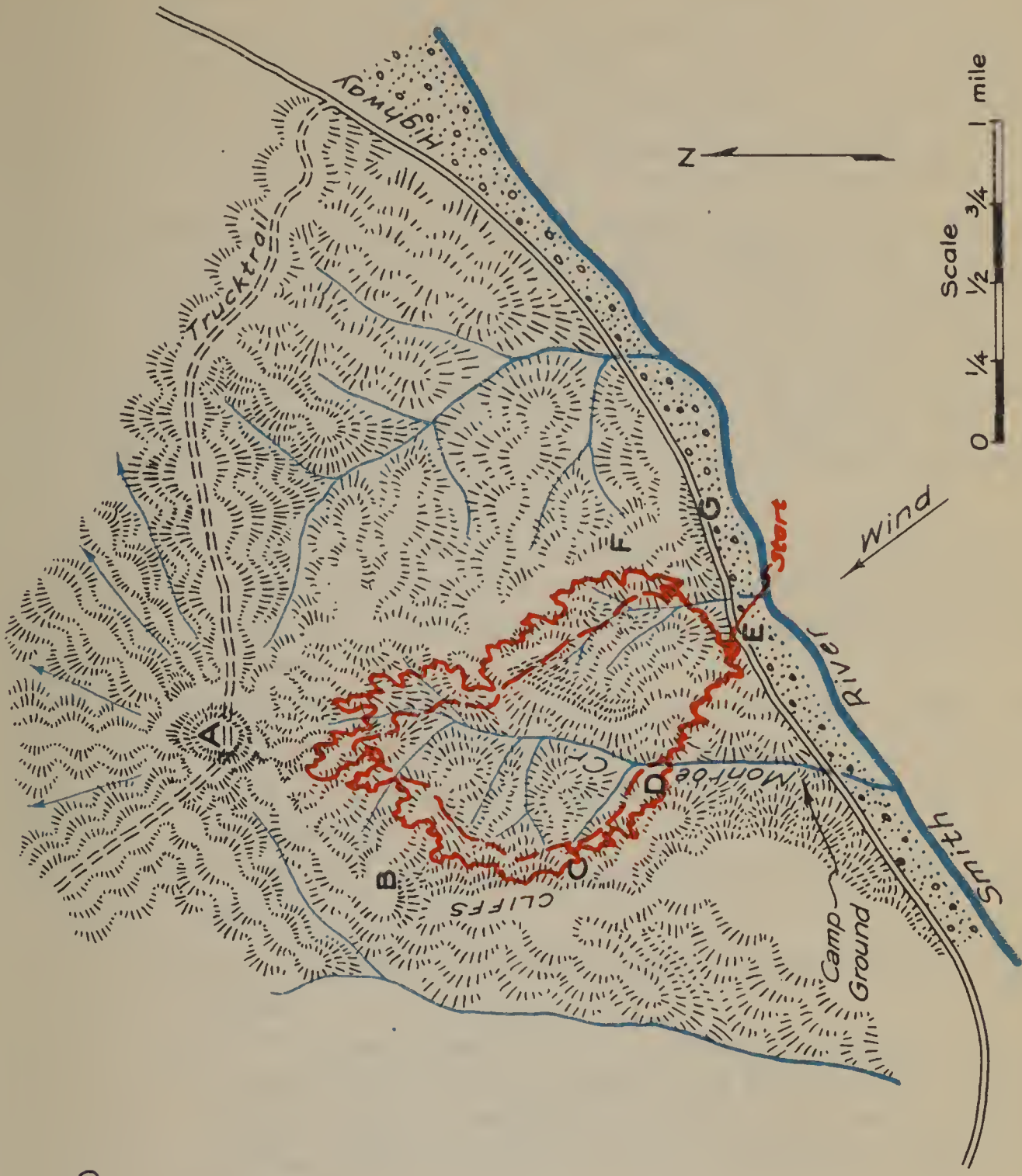
1. Suppression crew of foreman and four men have arrived at 3:30 P.M. from station twenty miles up highway. Dispatcher is mobilizing a crew of thirty men, with two foremen, from Badger Cr. road project to arrive on fire at 5:00 P.M.—three firemen to arrive at same time, one an experienced Camp Boss. Preliminary warning sent to CCC camp, one-and-one-half-hours' travel time away. to eat early and get ready to furnish up to 150 fire fighters.

Foreman has started crew working west flank of fire, which is not crowning, with idea of edging it away from camp ground.

### *District Ranger Arrives at 3:50 P.M.*

1. The Ranger hooks up emergency telephone to Forest Service line at camp ground and calls dispatcher and gives him brief description of situation as observed coming up highway, checks action already taken, as described above, and orders him to start trail builder with operator from Badger Cr. work project. Says he will size up fire and call again.
2. Ranger from low ridge across river sizes up problem as follows:
  - a. Fire is spreading rapidly toward northwest and has spotted across Monroe Creek, crowning in spots. Right flank not crowning but spreading mainly by roll toward small ravines. Present area about thirty acres.
  - b. From general weather forecast received in morning, which is no change from general conditions, and from his knowledge of wind and relative humidity behavior during last few days, he

Problem 10







feels that wind will drop about 6:00 to 6:30 P.M., with normal down draft in Monroe Canyon.

- c. He observes details of cover conditions, noting barren cliffs along west rim of Monroe Canyon. He figures fire will die to a ground fire about 6:30 P.M., with perimeter approximately as shown in red on sketch. He expects fire to keep on spreading slowly after that time, especially where cover is fairly open with a layer of pine needles. If untouched, he would expect fire to attain by morning the perimeter shown by dashed lines on the sketch, possibly slopping over ridges A-B and A-F.
- d. He figures control line cannot follow edge of fire without excessive length, many sharp angles, difficult clean-up of unburned patches, construction limited to hand methods, much undercut, hence hard line to hold next day, uphill draft from burned area, etc. Immediately dismisses this idea, and lays out plan of control as follows, using mainly ridge lines, which minimize the difficulties listed above. Breaks, if they occur, will be relatively easy to catch up.
  - (1) Ridge line from A to B—trail builder line—fall snags and backfire. Will send a small advance crew to this sector to catch any small runs that may occur before trail builder arrives.
  - (2) Cliffs B to C—no work necessary except to make certain no fingers of fuel extend across ridge.
  - (3) C-D on secondary ridge near probable edge of fire—all hand work.
  - (4) D-E—continuation of present direct attack from the lower end.
  - (5) A-F—ridge line by trail builder; snag falling and back-firing.
  - (6) F-E—direct attack if fire permits; otherwise continue tractor line F-G to highway and backfire F-G and G-E (F-E more desirable than F-G-E) to protect highway against rolling rocks, etc., and subsequent damage from erosion.
  - (7) Plans on early control to guard against possibility of unexpected spread, and to allow burning out lines as completely as possible by daylight.
- e. He estimates man-power and time required as follows, figuring conservatively on output per man-hour:
  - (1) Line A-B (40 ch.). Tractor crew of three men. 6:00 to 7:30 P.M.



- \*(a) Snag felling—20 snags—3 crews—9 men. 6:00 to 8:00 P.M.
- (b) Backfiring—2 men. 9:00 P.M. to 10:30 P.M.
- (c) Mop-up and patrol—12 men. 9:00 P.M. to 6:00 A.M.
- (2) Line A-F (110 ch.). Tractor crew of 3 men. 8:00 P.M. to 11:00 P.M. (Somewhat easier going than line A-B.)
- \*(a) Snag felling—55 snags—9 men from line A-B plus 9 additional. 8:30 P.M. to 11:00 P.M.
- (b) Backfiring—3 men. 9:00 P.M. to 11:30 P.M.
- (c) Mop-up and patrol—25 men. 9:00 P.M. to 6:00 A.M.
- (3) Line B-C (40 ch.). Experienced guard and 2 men. (Guard will blaze line A-B en route.) 5:00 P.M. to 10:00 P.M.
- (4) Line C-D (20 ch.). 10 men will build, mop-up and hold. 7:00 P.M. to 6:00 A.M.
- (5) Line D-E (20 ch.). 6 men to clean up and patrol. 6:00 P.M. to 6:00 A.M.
- (6) Line E-F (20 ch.). 20 men will build, clean burn, mop-up, and patrol. 6:00 P.M. to 6:00 A.M.
- f. He estimates the area within foregoing control lines as 450 acres.

| Summary                  |       | Control lines<br>Chains |
|--------------------------|-------|-------------------------|
| Trail builder crew ..... | 3 men | 150 chains              |
| Fallers .....            | 18 "  | 150 "                   |
| Backfiring .....         | 5 "   | 150 "                   |
| Mop-up A-B.....          | 12 "  | 40 "                    |
| Mop-up A-F.....          | 25 "  | 110 "                   |
| Line B-C.....            | 2 "   | 40 "                    |
| Line C-D.....            | 10 "  | 20 "                    |
| Line D-E.....            | 6 "   | 20 "                    |
| Line E-F.....            | 20 "  | 20 "                    |

Total man-power on lines..... 101 men

Line overhead needed

|                         |   |   |
|-------------------------|---|---|
| 1 foreman on A-B        | } | 7 |
| 1 const. foreman on A-F |   |   |
| 1 foreman on B-C        |   |   |
| 1 " " C-D               |   |   |
| 1 " " D-E               |   |   |
| 1 " " F-F               |   |   |
| 1 line inspector        |   |   |

\*Ranger estimates that snags run about one per acre and that they should be cleared for a width of five chains. This means about one snag for each two chains of line.

|  |         |       |
|--|---------|-------|
| Messengers, etc.....                                     | 4 men   |       |
| Preliminary estimate of patrol<br>force needed next day: |         |       |
| Patrolmen .....  | 50 "    |       |
| Overhead .....   |         | 8     |
|  |         | <hr/> |
| Total for two shifts.....                                | 155 men |       |
| Overhead .....   |         | 15    |

NOTE: As crews, such as fallers, completed their work they were used to supplement other crews to expedite work. Men not needed after midnight were sent to fire camp for rest. May be held until after noon as reserve next day if needed, otherwise demobilized.

g. Telephones dispatcher at 4:30 P.M.

- (1) Fire camp to be at Monroe Creek Camp Ground.
- (2) Dispatch 74 CCC's as soon as fed.
- (3) Follow up with 25 additional CCC's to bed down at fire camp and act as reserve. If not needed during night, will go on patrol in morning.
- (4) Send two more guards or men of similar qualifications.
- (5) Preliminary estimate of morning requirements:  
to be available, ready to go on line at 4:30 A.M.

25 CCC's

5 patrol foremen

1 competent relief fire boss

2 competent line inspectors.

\*1 relief tractor operator

\*1 tank truck and operator

Have 25 additional men prepared to come in morning if called for during night (safety measure).

The plan of control worked out with a few minor variations and the progress of the fire was stopped in the first burning period.

### *Summary of Correct Practices*

1. Adequate preparatory action taken by dispatcher.
2. First crew contributes held line.
3. Ranger sizes up situation, considering all factors, decides probable rate of spread, figures suppression forces needed, sector by sector, and plans for prompt control.
  - a. Takes advantage of natural barriers.
  - b. Selects lines of greatest speed and ease to build and hold.

\*Ranger plans to take tractor after it completes line A-F back to point A to convert line A-B into a way for tank truck and to help mop up this line. On account of forecasted wind direction, line A-B will be the most dangerous next day.



- c. Selects lines with view to using machinery.
- d. Considers all elements of the job, such as snag felling and back-firing.
- e. Takes precautions in respect to unforeseen troubles.
- 4. Adequate overhead is provided.
- 5. Sufficient safety factors are provided in both man-power and time.
- 6. Correct sequence in line construction and backfiring is planned and followed.

## **ORGANIZATION ON LARGE FIRES**

Once a fire gets beyond the one-crew stage, new problems arise in the division of duties and jobs of leaders on the line and in service of supply. There are new needs for coordinating effort, in obtaining information as a basis for planning and executing attack, in checking and inspecting work under way, and in adapting the organization as a whole to the job in hand.

To organize most effectively for any big fire requires:

- 1. Clear recognition of the form of organization required, as determined by the size and complexity of the suppression job.
- 2. Understanding of the workable and generally accepted lines of authority.
- 3. Knowledge of the titles, responsibilities and duties of key positions.

At any given time a large fire may be thought of as being in one of three stages.

1. Sector stage—in such shape that the line suppression job requires division into two or more sectors, each under a sector boss reporting directly to the fire boss.

2. Division stage—a situation of greater size or complexity, requiring the breaking of the line suppression job into two or more main divisions, each under a division boss reporting to the fire boss. Each division consists of two or more sectors.

3. Zone stage—a situation occasionally arising on very large fires where one or more sides are handled independently except for coordination of general strategy and mobilization. A zone will ordinarily consist of two or more main divisions, each with its required division boss reporting to the zone boss, who in turn is under the general direction of the fire boss.

The following section gives:

- 1. Measures useful in judging the complexity of the organization problem and determining the type of organization required.
- 2. Sample organization set-ups for typical sector, division and zone stage fires.
- 3. Responsibilities and duties of principal positions.

## DEFINITIONS, DUTIES, AUTHORITY AND JOBS

### Fire Boss

#### *Responsibility and Authority*

Is in general charge and has full authority for all action taken to suppress a fire.

#### *Jobs*

1. *Reconnaissance.* Initiates steps to establish scouting service that will give him full current information on the physical and climatological conditions on each fire front, the location of possible control lines, the spread of the fire and the progress of control measures. He covers as much of the actual fronts as he can to see conditions for himself. On sector stage fires, he can generally spend some time away from communications; on division and zone stage fires he must keep in communication, except for short periods during lulls.

2. *Strategy.* Formulates plan of action to control fires before the start of the next burning period, and issues orders to secure what is needed within suitable time limits to carry out his plan.

As conditions require convenes Board of Strategy, usually consisting of Assistant Fire Bosses, Chiefs of Staff, Zone Bosses and Division Bosses.

3. *Tactics.* Determines methods to carry out plan of action.

4. *Organization.* Assigns specific jobs as required by the size of the suppression job to designated officers, with due regard to qualifications.

5. *Camp Locations.* Determines where these will be, and designates headquarters camp.

6. *Miscellaneous.* Keeps Camp Boss or Chief of Staff posted as to his whereabouts at all times.

### Zone Boss

#### *Responsibility and Authority*

Is in charge of the execution of the general plan of action of the Fire Boss in a zone of a large fire. Makes detailed plans to carry this into operation, which plans are coordinated with the suppression of the fire as a whole. The Zone Boss is responsible to the Fire Boss.

#### *Jobs*

Are similar in every respect to those of the Fire Boss except that they are limited to a zone rather than to the whole fire, and that he acts as adviser to the Fire Boss in the determination of general strategy rather than as an independent agent.

### Division Boss

#### *Responsibility and Authority*

Is in general charge and has full authority to make and execute detailed plans for the control of a Division of a fire. These plans are in keeping



with the general plan made by the Fire Boss for controlling the entire fire. He reports to the Zone or Fire Boss. He supervises and coordinates the work of the Sector Bosses.

### *Jobs*

1. Obtains and checks to be sure he understands the written instructions from Fire or Zone Boss on:
  - a. General plan of action for Division and correlation with adjoining Divisions.
  - b. Location and boundary of Division.
  - c. Camp locations planned.
2. Secures from Fire or Zone Boss for his Division:
  - a. Names and qualifications of overhead available by shifts.
  - b. Man-power on job by shifts and that ordered to come in.
  - c. Special equipment available.
  - d. Transportation on hand to move men and horses for riding or packing if needed ; best routes of travel.
  - e. Best map available.
  - f. Weather reports currently, and transmits these to Sector Bosses.
3. Discusses and outlines work planned on each definitely designated Sector with Boss to whom each is assigned. Confirms instructions in writing.
4. Checks on communication needed to facilitate work in Division and places orders for required installations.
5. Anticipates need for special equipment and additional man-power, etc., and places advance orders so that they will be available when required.
6. Inspects in detail progress and quality of work on his Division at least twice each shift and applies corrective action promptly when needed.
7. Studies fire behavior and recommends to Fire or Zone Boss changes in plan of action to meet changed conditions.
8. Keeps Fire or Zone Boss informed currently in detail of developments on Division.
9. Keeps in touch with adjacent Division Bosses to unify work program.
10. Sees that Sector Bosses turn in information to Camp Boss needed to keep up Fire Progress map and organization chart.
11. Discusses Division plans for each shift with Camp Boss and secures his cooperation in meeting them. When operating out of a fire camp other than a Zone fire camp or Fire Headquarters, the Division Boss will be the Senior Officer in charge of all line and camp activities.
12. Turns over full information on developments and plans to his relief Division Boss for the period he is to be on duty.
13. Sits as a member of Fire Bosses' Board of Strategy, equipped with Division map, data, and proposed plan for next shift.

# Sector Boss

## *Responsibility and Authority*

Executes the detailed plans for one sector of a division or fire. Reports to Division Boss, except on smaller fires where there are no Divisions, he reports directly to the Fire Boss.

## *Jobs*

1. Obtains and studies written instructions from Division Boss as to location and boundary of sector, best routes of travel, and detailed plans of action to attain control objectives.

2. Keeps list, by shifts, of Crew Bosses and number of men available for each, adjusting numbers in crews to meet needs.

3. Sees that Crew Bosses check their men through timekeeper, and that they obtain the proper number and types of tools.

4. Assigns specific jobs on definitely described portions of line to each Crew Boss.

5. Covers in detail and checks progress and quality of work on his entire sector at least four times each shift.

6. Stimulates Crew Bosses, and where satisfactory accomplishment is not taking place, takes immediate corrective action.

7. Trains Crew Bosses in their jobs and in training crew personnel. Sees that Crew Bosses give adequate training to crew personnel.

8. Contacts adjoining Sector Bosses and correlates his work with theirs.

9. When conditions change, making it impossible or impracticable to carry out detailed plans previously agreed upon, notifies the Division Boss at once and agrees with him on new action. In case of a sudden emergency requiring immediate action, he uses his own judgment, reporting action taken to Division Boss as promptly as practicable.

10. Turns in record of accomplishments, *i. e.*, lines built, backfired and mopped-up, to Camp Boss for entering on progress record.

11. Remains on sector until relieved.

12. Acquaints relief Sector Boss with all conditions pertaining to sector.

13. Checks to determine that all his crews have been relieved and that the Crew Bosses have checked all men and equipment before leaving line.

14. In fire camp checks to see if Crew Bosses have checked in their men and tools, and have provided for their welfare.

15. Finds out where his Crew Bosses are sleeping while off shift in order to be able to mobilize men in a hurry if required.

16. Obtains from Division Boss the time crews are to be awakened, fed, and dispatched from camp, and advises Crew Bosses to take appropriate action.



## Crew Boss

### *Responsibility and Authority*

Executes the orders of the Sector Boss and directs the work of one crew. Reports to the Sector Boss or direct to the Fire Boss on smaller fires.

### *Jobs*

1. Sees that men get up promptly and go through mess line and eat as a unit.
2. Lists each member of his crew by name.
3. Inspects members of crew for clothing, shoes, etc., and if unsatisfactory, reports condition to Sector Boss.
4. Secures list of tools and other equipment needed and assigns to crew. Checks to determine if of kinds required and in proper shape.
5. Checks that water and lunches are available and that provision for future supply is made.
6. Learns definitely what transportation is provided for the crew.
7. Checks men through timekeeper, and on to trucks or other transportation.
8. Makes final check of men and equipment before leaving camp.
9. Secures from Sector Boss details of his job and of his line assignment, best route of travel thereto and the time objectives.
10. Assigns definite jobs to each crew member as required to get planned job done, and sees that they do these properly, trains them as need arises.
11. Remains on line assigned to his crew and works with them at all times.
12. Ties in work of crew with that of adjacent crews.
13. Pays special attention to and provides for safety of crew and renders first aid if needed.
14. Watches specially for dangerous conditions, such as spot fires, flare-ups, etc.
15. Keeps Sector Boss informed as to additional needs for men and equipment.
16. Remains on line until relieved.
17. Checks men, tools and equipment against personnel and tool lists and returns them to camp as units.
18. Checks in tools and equipment, accounting for shortages.
19. Checks in the crew through timekeeper.
20. Takes crew as unit through clean-up and mess.

21. Inspects crew members for health, clothing, etc., and reports conditions needing correction.

22. Ascertains rest area—when instructed, takes crew and obtains bedding.

23. Sees that crew sleeps in same general place.

24. Keeps men from milling around in camp.

25. Obtains from Sector Boss the time crew is to be awakened, fed, and dispatched from camp for line.

## **Assistant Fire Boss**

### *Responsibility and Authority*

Checks performance on plans of action; sees that all parts of job progress properly; takes immediate action to remedy discovered failures or deficiencies and reports action to Fire Boss. In emergency conditions modifies (in writing) previous plans and orders of the Fire Boss. In general does trouble shooting for Fire Boss on the line. Reports to Fire Boss.

### *Jobs*

Checks to determine if:

1. Best methods of fire fighting are being used.
2. Adequate overhead and man-power for all jobs is available.
3. Sufficient and correct tools and equipment are on hand.
4. Line units are correlated with adjacent units.
5. Suitable standards are followed as to line location, line construction, mop-up and patrol.
6. Line output is adequate under existing conditions.
7. Job as a whole is progressing satisfactorily.
8. Camps are functioning properly.
9. Service of supply is adequate.
10. Possibilities exist for using machinery.
11. Required records are kept.
12. Critical situations are being handled properly—aids in immediate planning for such situations as becomes necessary.

In addition he:

13. Does other jobs on assignment from Fire Boss.
14. Is prepared to sit in as a member of the Fire Bosses' Board of Strategy.
15. Functions on line for Fire Boss when size of fire requires that Fire Boss remain in camp.

## **Chief of Staff**

### *Responsibility and Authority*

Relieves the Fire Boss of all service of supply and administrative



duties, and as many executive functions as possible. Reports to Fire Boss or Zone Boss.

### *Jobs*

1. Assigns, supervises, and correlates the activities of the Communication, Transportation and Supply Chiefs and Liaison Officers.
2. Assigns assistants to the Camp Boss and aids him in getting started.
3. Lines up scouting and line inspector details for call as needed by the Fire Boss.
4. Coordinates and clears requisitions through the Dispatcher for suppression forces.
5. Checks to see that all line records and maps are promptly submitted by the line overhead when they arrive in camp. Has staff members submit summary reports at stated periods.
6. Sees that records and progress maps are posted daily at 7 A.M. and 7 P.M.
7. Maintains summary sheet for all overhead and man-power for entire fire.
8. Sees that a current record of all incoming men, equipment and supplies is maintained.
9. Records all important plans made and orders given by the Fire Boss.
10. Keeps a complete log of fire.
11. Writes and attends to transmission of instructions to carry out the plan of action and methods to be used as developed by the Fire Boss.
12. Assembles reports received from line inspectors, fire scouts, Zone Bosses, or Division Bosses.
13. Studies communications received from fire line and initiates action through channels as needed.
14. With Fire Boss, and on information from scouts, maps fire and divides it into divisions and sectors and assists him in developing proposed fire line organization.
15. Furnishes the Dispatcher's office with information on progress of fire and other developments at stated periods.
16. Notifies Dispatcher's office immediately when releasing men, equipment and supplies.

### **Liaison Officer**

#### *Responsibility and Authority*

Correlates the work of cooperating agencies with that of the Fire Boss. Reports to Fire Boss or to the Chief of Staff.

## *Jobs*

1. Keeps Fire Boss informed of any changes the cooperating agency may make that will affect his strategy.
2. Keeps cooperating agency informed of progress of fire and plans of the Fire Boss.
3. Correlates the work of cooperating agencies to avoid misunderstandings.
4. Sees that the cooperating agencies, if working under the jurisdiction of the Fire Boss, carry out his plan of action and methods of attack.

## **Scout**

### *Responsibility and Authority*

Obtains full information on the location, condition, progress and behavior of a small fire or section of a large fire as requested by his designated superior. Reports to Division, Zone, or Fire Boss, or Chief of Staff in absence of Fire Boss.

## *Jobs*

1. Does general scouting and mapping of fire perimeter or section of fire perimeter.
2. Scouts ahead of control crews, determining, mapping and reporting location and progress of fire, the type of cover and terrain, possible location for control lines, and probable changes in fire behavior.
3. Locates water in vicinity of possible control lines, and new camp sites.
4. Selects possible camp sites.
5. Selects possible means of access to fire edge and marks route of travel with suitable signs.
6. When necessary, acts as guide to suppression forces between fire camp and fire edge.
7. Keeps superior officer advised of status of control.
8. Makes recommendations as to man-power, tools and equipment necessary to accomplish control job on his section of fire.
9. If required, will mark location of control lines in advance of control forces.

## **Communication Chief**

### *Responsibility and Authority*

Plans, establishes and maintains all lines of communication needed in connection with the plan of control developed for the fire. Reports to Chief of Staff.



## *Jobs*

1. Develops adequate communication system to camps and on fire lines.
2. Obtains prompt delivery on fire of necessary communication instruments and construction supplies and supervises their installation.
3. Secures operators for established stations where needed, instructs them in duties, furnishes call cards and supplies and supervises operation.
4. Sets up a radio schedule (furnishing copy to all operators) to reduce interference to a minimum.
5. Maintains adequate supplies for prompt repair and maintenance of all communication facilities.
6. After installation is completed inspects performance of communication system currently. Remedies deficiencies.
7. Puts in standard system for recording and filing messages received or transmitted from written copy.
8. Maintains map record of stations and lines.

## **Supply Chief**

### *Responsibility and Authority*

Supplies all food, tools, equipment and commissary needed when the size of the job makes it necessary for the Chief of Staff to turn over these duties to a specially appointed man. Reports to Chief of Staff.

## *Jobs*

1. Anticipates needs of all fire camps and prepares plans for service of supply.
2. Makes all prearrangements for prompt ordering, delivery and distribution of supplies and equipment.
3. Collects and correlates orders from all fire camps for tools, commissary supplies and equipment. Fills orders to extent possible from stocks on hand, ordering additional supplies through proper channels when necessary.
4. Sees that Camp Bosses anticipate needs for tools and equipment and submit orders promptly; maintains adequate stock to meet needs; knows where surpluses are available for possible transfer.
5. Sees that Camp Bosses anticipate needs and place orders for subsistence supplies (where Forest Service runs mess) before 3:00 P.M. Determines if quantity and quality are being maintained.
6. When necessary to purchase supplies locally, secures approval of Chief of Staff, and procures in accordance with established procedure.

7. Maintains current inventory record of all tools and equipment, showing their location.
8. Sees that invoices are checked and record maintained of incoming subsistence and other supplies, and their distribution.
9. Maintains other records as required.
10. Secures from Chief of Staff clerical help as needed.

## **Transportation Chief**

### *Responsibility and Authority*

Provides and maintains all transportation facilities needed on the fire when the size of the fire job requires the Chief of Staff to turn over these duties to a specially appointed man. Reports to Chief of Staff.

### *Jobs*

1. Obtains transportation needs for all fire camps. Makes plans and prearrangements for securing same.
2. Collects requisitions for transportation facilities and supplies (gas, oil, parts, grease, forage, etc.); makes adjustments between camps where possible; orders through proper channels when necessary.
3. Decides disposition of equipment requiring major repairs; makes arrangements for replacements where necessary.
4. Obtains special equipment, such as tank trucks, trail builders, tractors, graders, pack and saddle stock, when requested by Chief of Staff.
5. Provides for inspection of mechanical condition of automotive equipment and for minor adjustments and repairs; inspects for proper functioning of all transportation personnel and equipment; inspects for compliance with safety requirements; inspects condition of animals and equipment, and forage supply; maintains written record, and file of inspection.
6. Maintains record of location of each piece of equipment and various items of supplies; records of use; records of gas and oil consumption; records use of rented trucks and animals to be turned in to Chief of Staff.
7. Sees that routes of travel used are posted with direction signs.
8. Sees that routes of travel are kept open and passable, or rerouting set up if conditions require.
9. Establishes traffic controls where needed to prevent congestion or accidents.

## **Line Inspector**

### *Responsibility and Authority*

On an assigned unit of a fire, checks performance as to carrying out of plans of action and progress of all phases of line work. Takes imme-



diates action to remedy discovered failures or deficiencies possible of remedy by him and reports others to Division Boss. Emergency conditions may require him to modify (in writing) previous plans and orders of Division Boss. Reports to Division Boss.

### *Jobs*

He inspects performance, and checks:

1. Whether best methods of fire fighting are being used.
2. On adequacy of tools available on line.
3. Adequacy of man-power for the job. Redistributes man-power where needed.
4. On correlation of line units.
5. To ascertain if proper standards are being followed in line location, line construction, mop-up, patrol, and if proper rates of production are being maintained. Checks as to whether workers are being trained currently as needed.
6. Adequacy and capability of overhead of all kinds.
7. To determine if line output is maximum possible under existing conditions.
8. To find out if job as a whole is progressing satisfactorily.
9. To see if lines are located in advance.
10. Adequacy of water supply.
11. On possibility of using machinery.
12. To see that proper communication is established and maintained.
13. To find out if Sector and Line Bosses are keeping required records.

In addition to foregoing duties, the Line Inspector notes possible secondary lines of defense, makes full report of inspection to the Division Boss, and handles other jobs, such as land or air scouting, as assigned.

## **Camp Boss**

### *Responsibility and Authority*

Establishes, operates, and abandons fire camps and supervises all work in connection with their operation. Reports to Fire, Zone or Division Boss, or Chief of Staff, depending on type of Fire Organization for the particular fire.

### *Jobs*

1. Plans the detailed arrangements and sets up the fire camp in the location previously agreed upon.
2. Organizes the staff set-up necessary to handle the various jobs in connection with camp operation.
3. Establishes communication with Dispatcher and fire line. (Turns this job over to the Communication Chief if the fire is large enough to need such a position.)

4. Determines when the first meal is needed and the number of men to be fed.

5. Furnishes this information to Mess Officer and checks to make sure that the meal is being prepared.

6. Initiates an inventory of all supplies and equipment in camp.

7. Designates sleeping areas and makes assignments.

8. Sees that warming fires are provided when needed.

9. Sees that men are fed, equipped, checked and in readiness for line duty as required.

10. Supervises reconditioning of tools brought in from lines.

11. When camp is abandoned, sees that all necessary records are brought up to date and filed for future reference.

12. Breaks camp and sees that it is properly cleaned up.

13. Sees that all tools and equipment are returned to proper destinations.

14. In the event the size of the fires does not warrant such aides as Timekeeper, Supply Officer, etc., the Camp Boss will assume such duties. On the larger fires he supervises his staff and checks their performance, with particular attention to the following:

#### *Camp Communication Officer*

a. Are communication channels functioning, messages being written and brought to the attention of right persons?

#### *Camp Supply Officer*

a. Is adequate supply of food, tools, equipment, commissary, and other supplies being maintained?

b. Is there prompt recording of all receipts and issue of supplies?

#### *Mess Officer* (when in Forest Service operated camp)

a. Are balanced rations on hand in sufficient quantities?

b. Are menus written, meals served and lunches prepared as needed?

c. Is sanitation being cared for?

d. Is kitchen personnel on shift basis?

e. Are all men and overhead kept out of kitchen except kitchen personnel on duty?

#### *Maps and Records Clerk*

a. Are maps and records being maintained currently?

#### *Truck Master*

a. Have loading and parking zones been established, and are they being adhered to?

b. Do drivers remain with trucks until relieved?

c. Are trucks maintained and serviced?



- d. Is dispatching system functioning and records of truck movements currently maintained?

#### *Tool Tender*

- a. Is all equipment checked and recorded as received and issued?
- b. Is tool supply in designated place and kept in an orderly and neat manner?
- c. Is reconditioning of all equipment done promptly and by experienced men?

#### *Timekeeper*

- a. Are records being kept in accordance with standard instructions to timekeepers where hired fire fighters are involved?
- b. Are accurate records of CCC men on fires being maintained?

#### *Chief Packer*

- a. Are loading and feeding zones established and being adhered to?
- b. Are forage and supplies adequate and necessary records maintained?
- c. Are shifts for packers and stock arranged?

### **TYPICAL BIG FIRE OVERHEAD ORGANIZATION**

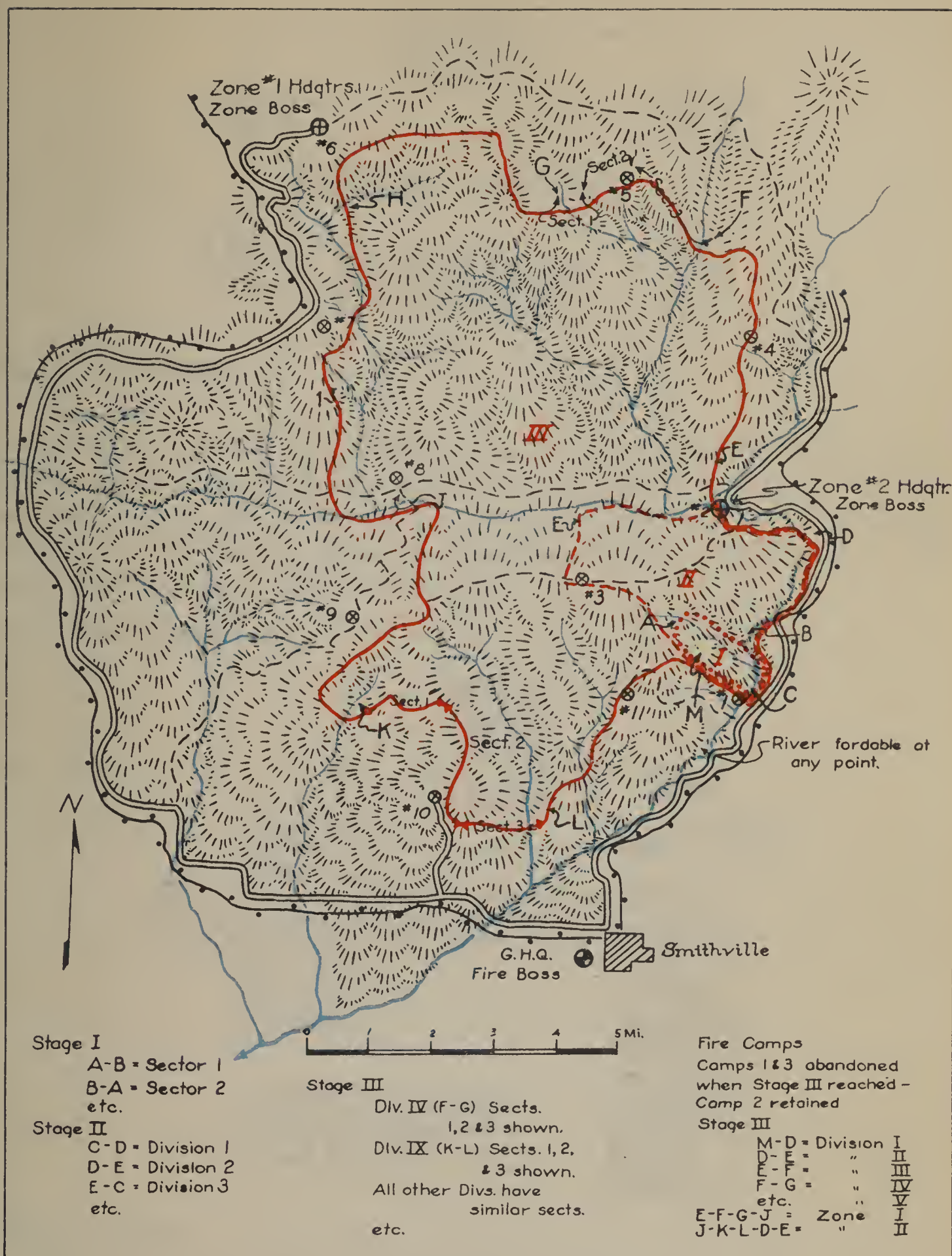
Typical overhead set-ups for sector, division, and zone stage fires, based on successive stages of an actual fire, are given on the following pages. The assumed organizations are not inflexible standards, but are illustrative of correct practices.

#### **Condition**

Very rugged country with an average rise of around 2,000 feet per mile; cover heavy, continuous brush; few roads into interior portions of area; no prepared firebreaks; water not well distributed throughout area; man-power, supplies, equipment and transportation equipment of all kinds readily obtainable; telephone system in reasonable proximity to fire.

#### **Stage I (Sector)**

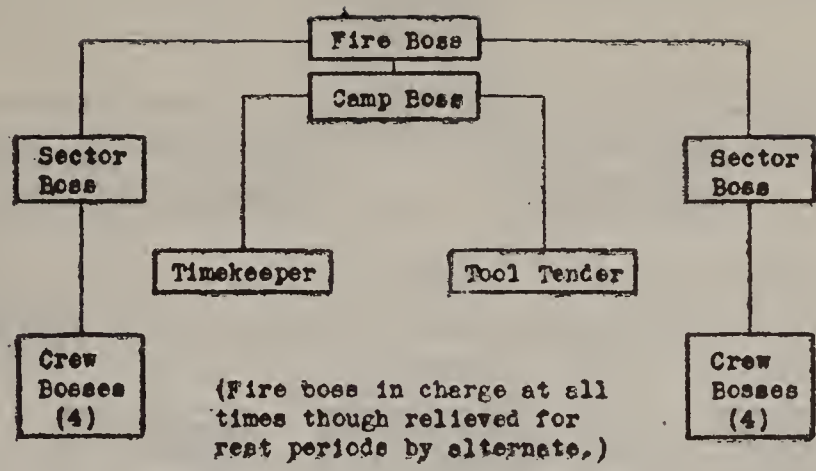
Area within the control lines planned to corral the fire was 800 acres; length of control line 5.5 miles, of which 1 mile was in canyon along river, with rest in steep, rough terrain. Approximately 250 fire fighters per shift.







Shift Organization

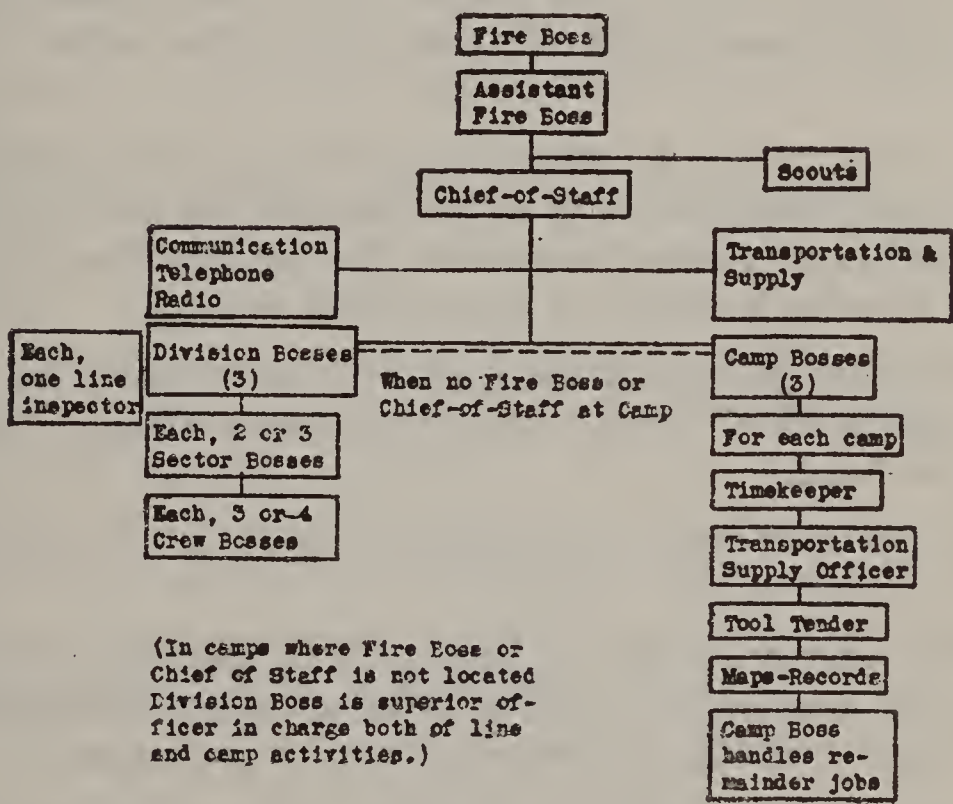


Stage 2 (Division)

Same fire

Fire escapes during next burning period. Plan of attack made to handle fire on proper control lines involves burned area of about 4,800 acres; perimeter 14.5 miles, of which 5 miles are in large canyon with a road along one side; balance still in very rugged country. Approximately 600 fire fighters on shift. See map for details.

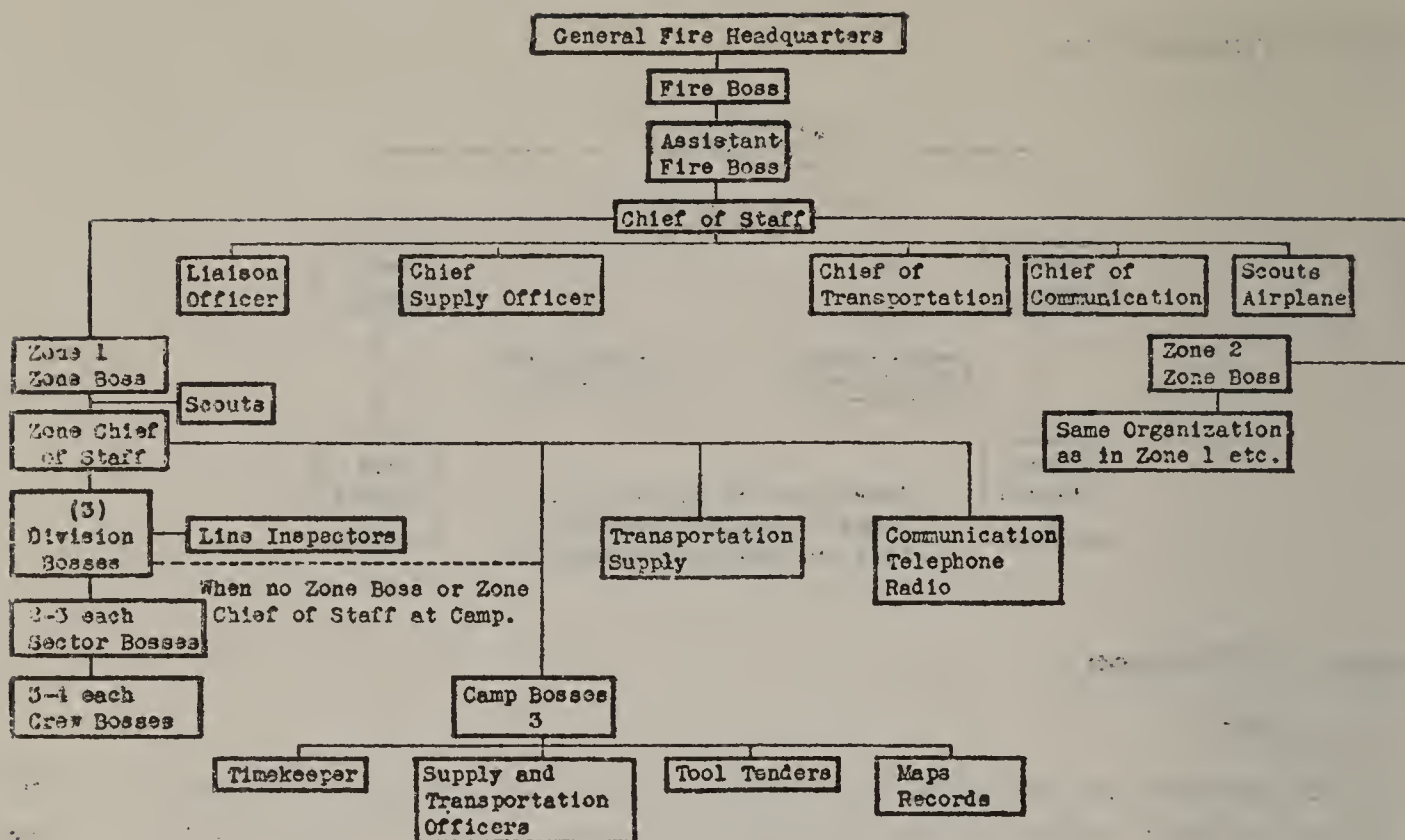
Shift Organization



Stage 3 (Zone)

Fire exploded and made wide spread in all directions except to the east; control plan on large scale operation covers wide front; organization planned to handle fire on control lines around an area of 39,000 acres; perimeter 52.5 miles; approximately 1,400 fire fighters per shift. See map.





## THINGS TO DO ON ALL LARGE FIRES

*Planning.* Appraise probable fire behavior with due regard to all factors and, after considering the size of the job, the facilities that are available and the probable rate of line output, with a reasonable allowance for underrun, develop a plan adequate to control each fire within the first burning period.

*Scouting.* Scout enough to know in detail the location and condition of all of the fire at all times, as well as the topographic and cover conditions of all of the adjacent country into which the fire threatens to spread. Use airplanes for scouting in rough or inaccessible country.

*Overhead.* See to it that sufficient qualified overhead is on hand by the time it is needed to fill all of the supervisory and staff jobs. See that there is balanced overhead.

Provide adequate trained field inspectors to check on suppression work on the line.

Conserve the energy of all overhead men by providing rest periods at regular intervals, preferably not over 14 hours apart, except during initial runs, when longer hours must frequently be put in to round up the fire.

Supply saddle stock promptly wherever it can be used to save the strength of all overhead above the grade of Crew Boss.

Utilize overhead on jobs for which they are qualified. Do not assign them to work above their abilities nor to that unsuited to them.

Make suitable arrangements in fire camps to expedite and facilitate the

work of the fire boss and other staff men. Reasonable privacy and comfort for staff meetings and discussion of plans must be provided. Supply a warmed tent in cold, windy weather.

Do not let overhead men bunch up either on the lines or in camps. Get high-grade men out onto the lines as well as into camp jobs.

*Man-power.* Conserve the man-power resource by:

Using only selected, properly equipped and physically fit individuals with a knowledge of the work to be done and of the country wherever possible. Do not take unfit or poorly equipped men onto the lines.

Working reasonable length of shifts, with regular rest periods.

Getting full production from men when they are working.

Providing adequate number of men for work at hand.

Giving good food. Creating quiet, comfortable conditions for rest.

Supplying water regularly to all crews.

Following best safety practices and assigning best qualified men to handle all jobs, particularly the more dangerous ones.

Treating injuries promptly with first aid and following up where needed with medical attention.

Insuring in advance safe ways of departure for all crews from places of danger.

Locating camps to make trips of men to and from lines as easy on men as is possible.

Transporting men as near to lines as possible in trucks.

Supplying best available tools in good condition and suitable for the jobs to be done.

Seeing that food, supplies, tools and equipment are delivered to the fire without delay, so that labor may be put to work immediately upon arrival if this is the planned use of the labor.

Releasing men promptly when need for them is over.

*Production.* Provide sufficient competent supervision to get as high accomplishment on all jobs as can possibly be expected, with due regard to the conditions met and the skill of the crews.

Correlate all phases of suppression between sectors, divisions or zones or with other agencies, if other agencies engaged.

Train men on the fire to perform in the proper manner the jobs assigned, whether it is handling tools or equipment or a supervisory job.

Utilize fully all existing barriers to reduce the size of the job.

Use machinery wherever possible to expedite or facilitate the completion of all work.



Use no more men than are needed to do the work at hand within safe limits of time and with full consideration to the fatigue factor. Send men to camp as they complete jobs and are not needed elsewhere, or if they work themselves out.

Do no more work than is really needed to handle the existing situations and provide a reasonable margin of safety.

Get the men onto the lines by daylight and before dark. Start feeding crews early enough to make this possible, with travel time given consideration.

Relieve men before dark to facilitate their return to camp.

Supply the best available lights for night work in sufficient number to permit all crews to work to best possible advantage.

Supply specialized tools for special jobs, such as backfiring.

Keep record of accomplishment in line production by cover types.

*Camps.* Develop smooth-running and efficient camps, with a minimum of effort and man-power consistent with needs of jobs.

*Costs.* Eliminate wastage of all kinds.

See that essential records, such as timekeeping, truck and horse hire hours and commissary charges, are kept completely and accurately.

Check all supplies, tools and equipment in and out of camp and in and off lines. Require strict property accountability all along the line.

Keep no more men out on night patrol than are needed to prevent loss of line. A few active men, effectively supervised and working to reduce hot spots, are worth much more than large crews sitting around warming themselves and doing little but drawing pay.

*Maps.* Secure and use freely in the field the best available maps. Keep the camp progress map up to date.

*Written orders.* Use notes very freely to avoid possible misunderstandings.

*Radio.* Get radio equipment onto all fires in the early stages and use it.

*Weather forecasts.* Try to get local forecasts wherever possible, but if these are not available, use other local observations as indicators, particularly immediate observations on relative humidity on fires.

*Danger from settlers.* Work out methods to prevent local residents from backfiring when it is not tied in to the control plan of the fire.

# **PREPAREDNESS**

## **ANALYSIS OF HISTORY AS BASIS FOR ACTION PLANS**

Systematic analysis of our own experience has proved to be one of the useful means of improving practices, defining policies, and judging the level of performance attained. Two main devices have been developed for current study and analysis.

### **REGIONAL BOARDS OF FIRE REVIEW**

The Regional Board of Fire Review will continue to hold formal meetings on three or more Forests annually, to make analyses of individual fires, of prevention activities and of organization.

For information on the report necessary for this meeting, refer to Revised Board of Fire Review outline in Appendix 1.

### **FOREST BOARDS OF REVIEW**

All Forests are expected to hold informal meetings to study in detail the prevention problem, the preparedness features of the job, and each individual large fire as soon after the fire is controlled as is possible. Failing in this, they should hold meetings at the close of the fire season to study their fire problems. The outline developed for the Regional Board Meetings may be used. A written report covering each meeting will be useful to the Regional Office.

## **FIRE CONTROL PLANNING**

The Service-wide fire-control planning project has been described in the third issue of Fire Control Notes (March, 1937).

This work will be a Regional Office project with wide participation by Forest personnel, and is to be completed by 1940.

The project will first review plans already worked up, namely, for Detection, Transportation and Communication systems. Planning for the other outlined phases will be undertaken. All planning will then be correlated between Forest units for the Region.

The Service-wide project contemplates further correlation among Regions as a basis for allotting fire control funds. This requires that all planning be on a sound base, and uniform between Forests and Regions. All plans are proposed methods of action, and as such the fire control planning results will dictate a program of action to be taken. Resulting policies, procedures and instructions will be issued to the fields as amendments to the FIRE CONTROL HANDBOOK.

Recommended modifications of the Detection and Communication plans should be submitted to the Regional Forester by March 15 of each year.



## FIRE DANGER METER PROJECT

Many factors enter into the rating of fire danger. This is now done in various ways by all men who have to determine current danger during the fire season. The factors ordinarily considered are the weather, the amount and condition of fuels, the effect of topography on fire spread, and fire risk, such as the presence of Forest visitors, their locations with respect to hazards, the activity and locations of fire-using industrial operations, and the likelihood of lightning storms. These facts are weighed in the light of the knowledge of the officer as to what they actually mean, and his judgment of the needs of the situation is based thereon.

More accurate methods of measuring the factors in fire danger have, in some Regions, been worked out in what is known as a "Danger Meter." This Region is now engaged in developing such a measuring device for every-day use, and a plan involving the establishment of the required field stations and other steps essential to gather data has been worked out. It is expected this will result in the fairly early production of a tool useful in evaluating and correlating all of the factors of fire danger.

### PLANNED REGIONAL STUDIES ON GOING FIRES

A group of studies, to be divided between Experiment Station and Administration men, will be undertaken on going fires. They include:

1. For each major fuel type, the rate of loss of men from line construction crew as they are dropped periodically to backfire, mop-up and patrol.
2. For each major type, separately for day and night work and for moderate and steep slopes, the output per man-hour in line construction only, expressed both in linear distance and in square feet.
3. Relative production with organized and trained crews and with pick-up crews.
4. Production losses through fatigue, including initial fatigue, cumulative fatigue on long shifts, effect of excessive heat, effect of steep, rough country, effect of various rest periods, etc.
5. Study of foremanship methods as determined by output of constructed line.
6. Speed of backfiring and man-power requirements by fuel types.

These studies will result in definite guides for estimating forces required for different kinds of suppression jobs.

# ANNUAL ACTION PLANS

## REGIONAL OFFICE EMERGENCY PLAN

The Regional Forester will issue an emergency plan annually covering such changing things as emergency addresses of personnel, names of airplane contractors, and supplies of tools in warehouses at Government Island, Mount Shasta, and Southern California. It will also cover the special action expected of Regional Office personnel in connection with fire suppression work. Copies of this plan will go to each Supervisor.

### NATIONAL FORESTS

#### Fire Atlas

The Fire Plan for each Forest in the Region will be based on analyses of the material in the Fire Atlas. This includes:

- a. Volume of Work map.
- b. Burned Area map.
- c. Fires by Causes maps.
- d. Hour Control map.
- e. Detection plan—visible area maps.
- f. Communication plan—maps.
- g. Transportation plan—organization maps.
- h. Risk reduction plan; maps and tabulations.
- i. Hazard reduction plan; maps and tabulations.
- j. Sheets A-N.
- k. Form 924, Annual Fire Report.
- l. Fire studies and analyses:

See Appendix 16 for instructions on preparing a to d inclusive, and Appendix 6 for items j and k.

The annual Forest fire control plan should be concise but forceful statements, giving definite instructions to all members of the Forest force as to what they are to do to prevent and suppress fires. The plan should repeat only in rare instances for special emphasis instructions given in the Region 5 FIRE CONTROL HANDBOOK. Cross reference to that publication for important points, such as "Elapsed Time Standards," is desirable. Do not repeat instructions given in other readily usable and available sources, such as "Law Enforcement Manual" and "Instructions to Timekeepers."

It is recommended that the plans be issued in two parts. One of these will be for the regular members of the Forest force and the other for the short-term men. The following outline is suggested for the material that should be covered in each section:



## Regular Force

### I. Introduction

- a. Explain purpose of plan and scheme of current revisions by fire orders.
- b. Give forest burned area objective.
- c. Emphasize priority of fire job.
- d. Emphasize individual responsibility for prevention and suppression in enough detail to bring this out clearly.

### II. Cooperation

Outline briefly cooperative relationships with adjoining units, between Ranger Districts, State, etc.; how to give and get help.

### III. Law Enforcement

Outline briefly Forest Officers' responsibility. List Justices of Peace.

### IV. Wage and Transportation Rates—list.

### V. Warehouse Stocks; show tools and equipment available from such sources.

### VI. Specific Instructions

Give instructions to different classes of men:

- a. On their part in the annual fire prevention program.
- b. What each will do in preparedness.
- c. On fire suppression action.
  1. On fires in units of which they are in charge
  2. On fires in adjoining territory
  3. On fires in State or privately protected areas
  4. On use of available CCC crews
  5. On use and care of tank trucks and machinery

### VII. Emergency Fire Plan

1. Define conditions of real emergencies, listing factors which must be present before such situations exist. Explain how plan will be brought into action when required.
2. Develop program on formal closures, if desirable, with positions provided for enforcement.
3. List all positions which must be manned to meet each crisis, setting these up separately for different types of emergencies, if varying treatment is required.
4. Outline plan to fill each emergency position by:
  - a. Moving guards of regular short-term force.
  - b. Moving road, trail or improvement crews.
  - c. Using CCC forces, either as emergency one- or two-man fire crews, to chase lightning fires, or as suppression crews.

- d. Getting permittees or cooperators to fill holes for short periods or to sit tight if requested.
- e. Appointing additional guards.
- 5. List either in plan or on organization chart for each emergency position in (4) above: Name of individual selected.
- 6. Outline special communication facilities that must be installed for each point to be occupied, and state who will handle.
- 7. Provide for dispatchers to make current checks on:
  - a. Immediate availability of local labor previously listed.
  - b. Availability of more distant organized crews that have been lined up, to be sure they can be secured on short notice.
  - c. Situation as to labor and overhead on adjacent Forests or other nearby protection agencies.
- 8. List agreements reached with industrial agencies using fire in the woods to curtail their activities when conditions become too dangerous. Assign to definite men the jobs of notifying specific agencies.

### VIII. Supplemental Data

- 1. Telephone number list.
- 2. List of Forest fire control personnel by name, locations and dates of entry on duty.
- 3. Timber Sale Fire Plans.
- 4. County Fire Ordinances.
- 5. County Agreements.
- 6. State Ranger Agreements.
- 7. Camp Fire Permit Issuance Instructions.
- 8. Local CCC agreements on use of men.
- 9. Any other local cooperative fire agreements in effect.
- 10. Organization charts (including Emergency forces); 1 in each Ranger's office, 1 to Supervisor, and 1 to adjoining Forests or Districts.

### Forest Guards

#### I. Introduction

Include as much of the regular force introduction material as is considered necessary.

#### II. Wage and transportation rates—list.

#### III. Warehouse lists

#### IV. Specific instructions

Include here by classes all instructions that are common to all persons in such classes as:

Fire prevention and preparedness duties.



Hours of duty ; daily time check and reports.

Care of person and quarters.

Uniform requirements ; what they are, where to get and when to wear.

Tools and equipment to be carried.

Camp fire permit issuance.

Emergency communication responsibilities.

Compensation for injury policy ; forms ; list of doctors.

Leave, local instructions how and when to take, etc.

V. Individual instructions for each position where material, in addition to general instructions is needed on points, such as :

Patrol routes ; extra equipment to be carried ; supply or water schedule ; specific zone of responsibility for emergency telephone line repairs ; special equipment men are to furnish ; upkeep of horses, etc. (Work these up also for men who are quite certain to be called on in emergency conditions.)

VI. Maps of District, showing essential protection features.

## Timber Sale

A written fire plan will be developed for each large National Forest timber sale. It will cover the duties of all Forest sale officers in preventing and suppressing fires, and their relationship to other members of the Forest Service, as well as to the purchaser and his employees. It will bring out the responsibilities of the operator for prevention and suppression. It will outline a program of action by all agencies when fires start. It will list the general equipment and preventive measures that are required of the operator by the timber sale contract. The following protection policies will be in effect on all sales through contractual provisions :

1. *Smoking* and the building of camp and lunch fires will be prohibited on all sale areas except at designated lunch grounds and fag stations.
2. *Tool caches* will be placed by the operator at points designated by the Forest Officer.
3. At least *one portable gasoline-driven pump* and 1,000 feet of 1½-inch fire hose, with nozzle, will be required on all sales where 20 or more men are employed in the woods during fire season ; this may also be required on smaller sales when considered necessary by Forest Officer. Portable pumps and hose will be required at each sawmill on or adjacent to National Forest land cutting 20,000 board feet or more daily.
4. One full-time *patrolman* will be required for each donkey logging camp working two sides or more in Government timber, June 1 to

October 1. For other types, one patrolman is required for each camp where 60,000 board feet or more are being logged per day during any part of this period. During periods of emergency caused by hazardous climatic conditions, the officer in charge may require additional patrols or such other emergency measures as he may determine to be necessary to meet the situation.

5. "*Shut-down*" clauses will be included in all steam-equipped operation contracts between the period June 1 to October 1, and in all other sale contracts where an average of over 5 men will be employed during the above period. These must be used sparingly.
6. All *donkey engines*, locomotives and other steam engines must either burn oil or operate the exhaust outside of the stacks between April 1 and November 15, unless fitted with a spark arrester satisfactory to the Forest Officer in charge.
7. At least one *tank car* of 5,000 gallons capacity, with pump and 1,000 feet of 1½-inch hose, with nozzle, will be required on all broad-gauge logging railroad apparatus unless the fire danger is not excessive, when it can be waived on small operations. On narrow-gauge operations, the minimum capacity should be 3,000 gallons.
8. *Clearing rights-of-way, steam loader and donkey settings* in advance is a standard requirement. All rights-of-way on National Forest land, and on lands owned or controlled by the purchaser within one-half mile of the sale area, must be properly cleared. All burning incidental to the clearing of rights-of-way or donkey settings shall be done before June 1 or after October 1 of any year unless waived in writing by the Forest Supervisor.
9. *Small sawmills* in forest areas are required to clean up their plants and live up literally to State law fire protection requirements as to arresters, etc. Sawdust should be very carefully disposed of.
10. *Spark arresters* are required on all types of steam and internal combustion logging or construction equipment during the period from April 1 to November 15 of each year. This must be inspected currently as to condition. (See Forest Management Handbook for further details.)
11. Purchasers of Government timber shall do independently all in their power to prevent and suppress forest fires on the sale area and vicinity; and shall place their employees at the disposal of any authorized Forest Officer for the purpose of fighting fires. (See Forest Management Handbook for further details of liability, reimbursement, etc.)



Overhead on Large Fires or Concentrations

A. Normal Fire Situations

The Forest Annual Fire Plan will provide for such personnel shifts among Districts of a Forest or among staff members as are needed to handle emergencies arising on any units. In addition, definite plans to utilize qualified local men and employees of other protection agencies will be worked up.

B. Emergencies Above Ability of Units to Handle, Line of Action.  
Second Line

The four Southern Forests will arrange in advance for interchange of overhead.

Northern Forests will arrange in advance for overhead interchange as follows:

|                 |                      |
|-----------------|----------------------|
| Sequoia.....    | Sierra and Inyo      |
| Sierra.....     | Inyo and Stanislaus  |
| Inyo.....       | Sequoia and Mono     |
| Mono.....       | Inyo and Stanislaus  |
| Eldorado.....   | Tahoe and Stanislaus |
| Stanislaus..... | Sierra and Eldorado  |
| Tahoe.....      | Plumas and Eldorado  |
| Plumas.....     | Tahoe and Lassen     |
| Lassen.....     | Plumas and Modoc     |
| Modoc.....      | Shasta and Lassen    |
| Shasta.....     | Klamath and Modoc    |
| Klamath.....    | Shasta and Trinity   |
| Trinity.....    | Shasta and Mendocino |
| Mendocino.....  | Tahoe and Trinity    |

C. Third Line

Obtain from Regional Forester after reporting what has been done to exhaust Second Line possibilities.

SELECTING AND TRAINING PERSONNEL

Practices of proved merit are discussed in the following pages.

HIRING WOMEN AS LOOKOUTS

Women will not be hired as full-time lookouts.

Where a study of the situation shows the most practical way to handle the temporary replacement of lookouts or lookout-firemen, while they are on fires, is by assigning the men's wives to the jobs rather than to send in outside replacements, definite arrangements will be made in advance by the Ranger not only to have the wives trained to handle the duties of the positions but also as to rates of pay for such emergency work.

On points where the number of fires to which lookout-firemen are sent is large, the assignment of guards with wives who are willing and fitted to serve as temporary replacements will be worked out as part of the Forest preparedness plan.

### GUARD RECRUITING

The process of seeking out and getting high-quality men interested in short-term jobs is a never-ending one for every Forest Officer. Every possible means should be utilized to obtain and hold the services of the best-equipped men who are available. Efforts to make the conditions of employment attractive, and under existing financial limitations to extend the periods of work beyond the fire season, are positive means of getting and holding men of high quality.

Local men with knowledge of the country obviously start with a distinct advantage, and, if they have the other essential qualities, they can be the source of much worthwhile material. Forest school students, too, can be used on certain types of protection work, and it is desirable that as many such men as can be employed in suitable jobs be put on duty each year. These men can be secured either through local school contacts by the Supervisor direct, or through the Regional Forester who works up a program for such employments annually.

### GUARD EXAMINATION

In the effort to systematize and to give basic material on the factors to include in the size-up and selection of recruits for protection jobs, as well as the rating of the older men, a guard examination and rating scheme has been developed in the Region. The older men are first given a rating based on their past work. The results of the examination and ratings are then compared. Copies of the forms are in Appendix 13. Extras for use in giving examinations can be obtained on requisition.

Where additional men are needed on a Forest, or a register is desired for replacements, such examinations should be given annually.

### Medical

#### *General*

Supervisors will require all prospective guards to take thorough medical examinations, at the men's expense, in advance of their appointment, wherever there is any question as to their physical fitness to handle the jobs for which they are being considered.

#### *Lookouts*

Must take individual examinations, including the regular doctor's eye test, before they go on duty initially, and at least every two years thereafter.



## **Eyesight Tests**

It will be standard practice to give a special eyesight test to all candidates for lookout or lookout-fireman jobs before they are assigned to such work. Men rating less than "good" should never be assigned to positions where detection is the keynote. Men rated "poor" should never be used in a position where detection is involved. Checks should be made of the actual field range of vision of the men before they are assigned to duty. Instructions for giving the test and sample of rating form are given in Appendix 3.

## **GUARD TRAINING**

All guards will be given at least three days of intensive training annually in guard training camps. In addition, they will receive such additional training on the job as will fit them to handle in full the duties of the position they are filling. The 1937 Service Guard Training Handbook and that of Region 5 should be used as a teaching text.

### **Teaching the Guard His Country**

Whenever the Guard is not already thoroughly acquainted with his country he must be given detailed instruction on it as early as possible. This must be done systematically to be sure the Guard learns all of the routes of travel, locations of water and other essential field facts.

Several ways to do part of the job thoroughly, with a minimum of effort, are:

1. Assign Guards of all classes to spring maintenance of telephone lines, pasture fences, camp grounds and trails within their units.

2. Give Guards marked maps and send them out to replace fire warning signs at designated places.

3. Have Guards take exploration trips on designated routes at times of relatively low danger into places difficult of access or unknown to them.

4. Let the Guard accompany the Ranger or assistant on range inspection or other field trips.

5. Make a check list of important points lookout should identify on his maps—through his finder—and have him jot down the readings of these, showing the points to the Ranger on his first inspection trip.

Further special trips and teaching at the actual point of duty must be made if the above does not cover the entire area.

## **TRAINING RANGERS AND STAFF MEN ON FIRES**

Assistant Supervisors and Rangers should be assigned, along with representatives of the Regional Office, to study organization and methods on large fires. Constructive discussion, preferably with man in charge, and

written comments should be made by the groups on all such large fires attended for training.

The importance of training all men in suppression jobs, on which the need of this is indicated, at the earliest possible date, either on the Forest to which the man belongs or on assignments to other Forests, should not be overlooked. Supervisors must be sure to advise each other when men are sent on training assignments so the full value is received from such trips.

### **CREDENTIAL CARDS**

Three copies of the credential cards will be filled out by the Supervisor for each member of his Forest force who may be called upon to act in some capacity on a fire, prior to the opening of the fire season. One copy will be given to the individual for him to carry, and one to be retained by the Supervisor. Credential cards of individuals available for suppression assignments on other Forests should be furnished the Regional Forester. A supply of forms can be obtained on requisition. It is not necessary to remake these cards for permanent members of the force annually, though these should be checked that often to be sure they represent the conditions at the time.

### **CHECK LIST OF PREPAREDNESS JOBS**

#### **SUPERVISOR**

The Supervisor will see that the following matters are attended to in advance of the fire season:

1. Forest fire plan reviewed and brought up to date, with necessary individual instructions issued.
2. Arrangements made with cooperating agencies.
3. All timberland owners subject to the compulsory patrol law listed, and cooperation solicited.
4. Guard training program and lesson plans prepared.
5. Guard training group meeting held.
6. Best maps for lookouts made available.
7. Selection of short-term force completed.
8. Interviews had with settlers, users, permittees and local employers of labor to obtain their cooperation and to acquaint them with the fire laws.
9. Investigation of special risks made and remedial measures taken.
10. All hazard reduction work completed, especially roadside clearing, burning around Service buildings, camp grounds and wherever possible around local residences.
11. Stores furnished with standard ration lists and explanation of procedure.



12. Advance local arrangements made for hire of automobiles, trucks, pack and rollable stock.
13. All local camp fire permit agents appointed and instructed.
14. Normal stocks of fire tools and equipment branded, conditioned, painted and distributed at proper key points ready for use.
15. Labor agents, where necessary, selected, instructions furnished.
16. Forest fire sign posting program completed.
17. CCC enrollees trained in fire suppression.
18. Telephone maintenance work completed and up to standard.
19. Plans for radio communication completed.
20. Guard and lookout buildings ready for occupancy.
21. Camp grounds opened for public use.
22. Roads and trails cleared of logs and slides, and whenever possible fully maintained.

### **RANGER**

The Ranger is responsible for execution of preparedness jobs listed on Supervisor's check list, as assigned by Supervisor.

He is responsible for inspection of guard preparedness, and will use the Guard Weekly Inspection form as basis for his inspection.

## **COOPERATION AND COOPERATIVE AGREEMENTS**

### **CCC AGENCIES**

#### **Army**

Yearly each Army District Commander works up a fire plan for his CCC District which sets forth the lines of action to be followed by the Army in fire suppression work.

The Supervisors of the following Forests are assigned the responsibility of working with the respective District Commanders to assist in every way possible in the development of a fire plan for the District listed:

|                           |          |
|---------------------------|----------|
| Fresno District.....      | Sierra   |
| Medford District.....     | Klamath  |
| Sacramento District.....  | Eldorado |
| Los Angeles District..... | Angeles  |

These fire plans should be in final form well before the opening dates of the fire season, and a copy filed with the Regional Office for information.

Messing in Army fire camps should conform to the messing policy issued by the Regional Office each year.

#### **Technical Agencies**

The Regional Office annually executes agreements with the following agencies:

1. Biological Survey CCC
2. Soil Conservation Service CCC.
3. Division of Grazing CCC
4. Reclamation Service CCC
5. State Park Service CCC

These agreements outline the provisions of cooperation in fire suppression between the Forest Service and these agencies. Copies of these Regional agreements will be furnished the field in advance of each fire season.

Supervisors should confer with the agencies concerned in the vicinity of their Forests and work out in detail matters of local cooperation on fires, following the policies of the Regional agreement.

### **Indian Service**

In the Civilian Conservation Corps program, the Indian Service expects to cooperate with the Forest Service and other agencies in time of stress. In cases where it is necessary for CCC enrollees and equipment to be used in the suppression of fires on areas supervised by agencies other than the Indian Service, no charge will be made against the other agencies for such use or loan of CCC equipment, tools or supplies, or the replacement or repair thereof if lost, destroyed or damaged. In like manner, the Forest Service and other agencies will not expect reimbursement for CCC expenditures on Indian lands.

## **FEDERAL DEPARTMENTS OR BUREAUS**

### **Bureau of Public Roads**

By agreement of June 28, 1924, the following is effective:

1. All agents and employees of the Bureau will suppress all fires, within or threatening National Forests for which they are responsible, and will report such fires to the nearest Forest Officer. All contractors of the Bureau will suppress such fires in accordance with their contracts. All expense for labor, supplies and equipment incurred by the Bureau because of such fires, except those caused by contractor, will be borne by the Bureau.
2. Agents, employees and contractors of the Bureau will report all fires within or threatening the Forest and reasonably adjacent to the right of way of Forest Highways, for which they are not responsible, and will take charge of such fires until a Forest Officer arrives. All expense of labor and supplies, and travel and subsistence of Bureau officers in connection with such fires, will be borne by the Forest Service, except wear and tear on equipment furnished by the Bureau and salaries of permanent employees of the Bureau. Labor will be paid at current Forest Service fire-fighting rates.



3. The Forest Service must furnish warning signs for all camps within the National Forests, to be posted by Bureau officers. In large camps, a Bureau employee should act as Fire Chief.
4. In the absence of other help, crews and employees of the Bureau within the National Forests may be called upon by Forest Officers to suppress fires, regardless of their origin, and should promptly comply until other fire-fighting forces are available. All expenses under this operation are to be handled the same as set forth in Clause 2.
5. During the fire season, all employees, agents or contractors of the Bureau shall secure burning permits from the appropriate Forest Officer before burning brush in connection with Forest Highway operations. Telephone connections with B.P.R. road camps should be furnished where possible.

### **Indian Service**

A cooperative fire agreement between the Secretary of Interior and Secretary of Agriculture includes the following:

1. Details of cooperation in fire protection will be worked out, preferably through conference, between employees of the Indian Service and Forest Supervisors of the Forest Service.
2. Field officers will remain under the jurisdiction of their respective Departments.
3. The primary control by lookouts for a given area of timberland or brushland will be worked out by the Indian Service and the Forest Service as far as possible without regard to boundary lines and Departmental jurisdiction.
4. Primary (permanent) lookouts maintained by the Indian Service will be furnished by the Forest Service with fire control maps of adjacent National Forest areas, and lookouts maintained by the Forest Service will be furnished by the Indian Service with control maps of adjacent Indian Reservation area. All stations will be furnished with equipment needed in the control of fires as agreed upon between the Forest Service and the Indian Service.
5. Local employees of the Indian Service will be supplied with copies of fire plans and maps for adjacent National Forests, and will supply Forest Supervisors with copies of fire plans and maps for Indian Reservations.
6. The organization of patrol will be maintained separately by each Service; however, patrol routes will be so arranged as to provide the most efficient patrol with as little duplication as possible.

7. Wherever practicable telephone communication will be established between National Forests and adjoining Indian Reservations.
8. Fires occurring on an Indian Reservation and discovered by National Forest officers will be reported promptly to the Indian Superintendent or nearest forest officer of the Indian Service. Forest officers of the Indian Service will act similarly in regard to fires discovered by them on National Forests.
9. An officer of the Forest Service will go to a fire discovered on reservation lands and fight it until relieved by a forest officer of the Indian Service, provided the fire is within reasonable distance of the National Forest boundary or endangers National Forest timber, and to go to it will not leave unduly exposed the district for which the National Forest officer is responsible. Similar action will be taken by employees of the Indian Service with respect to fires discovered by them on National Forest land.
10. National Forest officers will render assistance to Indian Service forest officers in fire fighting upon request in every case where such action will not leave National Forest land unduly exposed to fire danger. Officers of the Indian Service will reciprocate.
11. If, in the case of a fire discovered on an Indian Reservation by a National Forest officer, it should be impossible for any reason to communicate with the Indian Service in time to have a forest officer of the Indian Service take charge before the fire assumes serious proportions, the National Forest officer will, if practicable, take immediate charge and employ all necessary assistance to extinguish the fire. The expense, not including the salaries of regular employees, will be paid by the Forest Service and the Forest Service will later be reimbursed therefor from the funds of the Indian Service through Treasury settlement; provided that in no event shall the expense incurred by the Forest Service prior to turning the control over to the Indian Service exceed \$500. A similar course of action shall be followed in the case of a fire discovered by a Forest officer of the Indian Service on a National Forest when it is impossible for the officer of the Indian Service to communicate with an officer of the National Forest in time to have the Forest Service take control before the fire assumes serious proportions.

### **National Park Service**

There is no general agreement with the National Park Service. Each Supervisor, or in case of the Yosemite the group of Supervisors, will work up a written agreement with the National Park Superintendent. These agreements may cover a period of years, if mutually agreeable, subject to appropriations, and may be revocable prior to the opening of each ensuing



fire season. Copies of such agreements should go to the Regional Forester for information.

### **Post Office Department**

Post Office employees are instructed by the Postmaster General as outlined below:

1. Rural mail carriers and star-route contractors shall report the discovery of fires to the nearest State fire warden or National Forest officer on his route; if no warden or officer lives on his route, to arrange through some responsible citizen to have him notified by telephone.
2. Local Postmasters in or near National Forests are also directed to report fires to the nearest Forest officers.

Supervisors and Rangers should make contact with all local postoffice employees.

### **Weather Bureau**

Forest officers will assist the Weather Bureau at such points as may be agreed upon in gathering basic weather data so that these may be used for better forecasting.

Requests for special local forecasts may be made to the Weather Bureau by any Forest when such service is desired.

Special forecasting units will operate in the Region each year in accordance with the details of a program outlined in the Regional Emergency Plan.

## **STATE AGENCIES**

### **California State Division of Forestry**

Due to possible changes in the June 2, 1932, agreement with the State Division of Forestry, Department of Natural Resources, California, its contents are not included here.

Until a new agreement is drawn up and executed, the present agreement will remain in effect.

Section 5 of the present agreement provides for reimbursement of fire-fighting costs only when action is taken in accordance with the local fire plan or upon special request. This means that the Forest Service can expect reimbursement from the State only when it takes action in conformity with the local fire plan and agreement or upon special request of a State officer.

#### *Reimbursement from the State*

##### *A. State fires not threatening National Forest areas of responsibility.*

Reimbursement of F.F. funds expended will be made in accordance with Sections 5 and 6 of the June 2, 1932, agreement.

B. *Joint Fires along National Forest boundary.*

The usual procedure will be for each agency to pay the costs incurred by itself. Where this is not equitable or practicable an adjustment should be made on the ground upon as fair a basis as possible, considering relative areas burned, relative values at stake, and special agreement in the fire plan or those entered into during the course of the fire. If the adjustment cannot be handled by having each agency pay the determined share of the cost directly, the adjustment claim should be filed promptly with the agency concerned.

To obtain reimbursement in (A) and (B) above, the Supervisor will submit promptly to the State Forester at Sacramento a letter of transmittal in triplicate, requesting the amount involved, with substantiating evidence of payment by the Forest Service (*i. e.*, voucher number, name of fire, area burned, location, etc.). Do not include equipment purchases except for tools actually expended on the fire. It will expedite payment if the proposed settlements are first discussed with the State ranger concerned and an agreement reached if possible.

Such reimbursements are F.F. repayments, and the letter of transmittal should state that this appropriation is to be credited.

*Appointment of State Voluntary Fire Wardens*

The following policy of the State Forester governs appointments as State Voluntary Fire Wardens:

1. Hold appointments to a minimum.
2. Recommend for appointment as Voluntary Fire Wardens
  - a. Regular year-long men who do not have appointments.
  - b. Members of the short-term force needed to enforce the State fire laws.
3. *Do not recommend* for appointment primary lookouts, emergency guards, individuals not on Forest payroll, and supervisory personnel of the CCC who are not connected directly with fire work or law enforcement.
4. *Appointment papers.*
  - a. All appointment papers will be held in the live files of the Supervisor's office as long as appointments remain in force.
  - b. When recommending cancellation of an appointment, attach the appointment paper to the letter to the State Forester.
5. *Badges.*
  - a. Year-long men will retain possession of badges as long as they remain in the employ of the Region and continue to hold voluntary fire warden status.



- b. Badges of all short-term men will be returned to the Supervisor's office at close of fire season to be reissued to the same individuals at the beginning of the next fire season if they are re-employed.
  - c. When an appointment of a member of the short-term force is cancelled retain badge in Supervisor's office file.
  - d. When recommending to the State Forester a new man for appointment and an extra badge is available, as explained in (c) above, give the number of the badge to the State Forester so he may assign it to the new man. In case of no badge follow usual procedure.
  - e. Do not issue badges until certificate of authority covering the individual is received.
6. a. When members of year-long force are transferred to another Forest or to the Regional Office, send their appointment papers to the State Forester, requesting him to reissue for the new location but with same badge number.
  - b. Cancel appointments of any regular men transferred out of Region and return badges and certificates of appointment to State Forester.
  - c. Cancel appointment of short-term force who are not to be re-employed for the following fire season.

7. *Annual report to State Forester*

By December 15th each year, each Forest will submit directly to the State Forester a list showing all Voluntary Fire Warden appointments as follows:

| Name of Appointee | Badge |                   |                    |                 |      | Appointment to be |           |
|-------------------|-------|-------------------|--------------------|-----------------|------|-------------------|-----------|
|                   | No.   | Held by appointee | Held by Supervisor | Return to State | Lost | Continued         | Cancelled |
|                   |       |                   |                    |                 |      |                   |           |
|                   |       |                   |                    |                 |      |                   |           |
|                   |       |                   |                    |                 |      |                   |           |

*Cooperative fire plans with State Rangers:*

Cooperative fire plans with local State Rangers will be drawn up and executed prior to the opening date of the fire season. The provisions of such agreements should contain:

1. Location of protection boundaries.
2. Location of cooperative fire collection boundary—this boundary should conform as closely as possible to the protection boundary.
3. Assistance on State fires not threatening National Forest zones of responsibility.

4. Assistance along immediate protection boundary.
5. Payment of fire-fighting bills in accordance with agreement with State Forester dated June 2, 1932.
6. Distance second line of defense crews will be dispatched to State fires.
7. Dispatching channels.
8. Responsibility of first officer arriving on fire.
9. Responsibility of payment for overrun in Army fire camps.
10. Release of men.
11. Tools and equipment to go with crews.
12. Handling joint fires.
13. Use of CCC forces.
14. Replacement and reconditioning of equipment used on fires.

### **California State Fish and Game Commission**

The Fire Cooperation sections of the agreement with the Fish and Game Commission, Department of Natural Resources of California, follow :

1. Deputies of the Division of Fish and Game will pay strict attention to the enforcement of State Fire Laws; familiarize themselves with and obey the regulations governing the use of the National Forests, and by personal actions and attitude assist in creating the right public reaction and sentiment toward these laws and regulations.
2. Upon request from the Regional Forester that any Deputy of the Division of Fish and Game be appointed a State Fire Warden, the Fish and Game Commission will forward this request to the State Forester of California, accompanied by a recommendation that such appointment be made. The Fish and Game Commission will instruct all its deputies who receive appointment as State Fire Warden to cooperate fully with the Forest Service in the prevention and suppression of forest fires. When such deputies are actually engaged in the work of suppressing or preventing fires, the State Fish and Game Commission will pay their salaries, and the Forest Service their expenses. The calls for the services of such men will be limited to cases of actual emergency.

### **California State Highway Commission**

A. State Highway Commission agrees :

1. In the case of fires for which the agents or construction contractor of the State Highway Commission are responsible:
  - a. Immediate action will be taken by the available personnel of the Highway Commission to suppress the fire.
  - b. Highway officers will report such fires to the nearest designated and agreed upon Forest Officer.



c. The expenses for labor, supplies and equipment contributed in suppressing such fires will not be a charge against the Forest Service.

2. In the case of fires for which the agents or employees of the State Highway Commission are not responsible, and originating within or reasonably adjacent to the rights of way of State Highways within National Forests where construction and maintenance crews are maintained by the State Highway Commission:

a. Employees of the State Highway Commission will be instructed to report such fires to the nearest designated Forest Officer.

b. Such fires will be handled by their available forces until the arrival of Forest Officers.

3. Employees, agents and contractors of the Highway Commission will be informed forcefully of and required to obey all of the State fire prevention laws through the issuance of written instructions to employees and inclusion of appropriate clauses in such contracts as may be executed by contractors.

4. Fire warning signs furnished by the Forest Service will be posted at all camps established by the Highway Commission or their contractors.

5. In large camps, an individual will be designated to act as fire chief, whose duty it will be to see that the provisions of this agreement are carried out.

B. The Forest Service agrees:

1. Forest officers will proceed to and take full charge of fires on or adjacent to rights of way or construction camps of the Highway Commission upon learning of such fires.

2. All expenses for suppression of such fires will be borne by the Forest Service at the current fire-fighting rate for wages and equipment except as provided for in paragraph A. 1. c.

C. General:

1. All crews and employees of the Highway Commission working within National Forests shall be subject to temporary call by Forest officers to suppress fires; such employees and crews to be released as soon as other fire-fighting forces are available.

2. Brush burning will not be done between May 15 and October 31 without first obtaining a permit from the nearest Forest Officer.

To be sure that hazard reduction on State Highways is done where it will be most effective, and to give the State Highway officials a complete

picture of the size and nature of the job, each Forest should prepare an annual log of the Highways in and adjacent to the boundaries, showing action required by miles and fractions. Map should be turned in to the State Highway Division Engineers each year at a sufficiently early date so that estimated expenditures may be included in their annual budget of needs.

### **California State Highway Patrol**

On June 26, 1935, orders were issued by Chief, California Highway Patrol, to all District Inspectors, Captains and Traffic Officers to seek to prevent fires and to ask for cooperation in fire prevention.

This covered the enforcement of Paragraph 5, Sec. 384, relative to the throwing of burning materials from moving vehicles, and Paragraph 9, Sec. 384, which forbids the operation and moving of motors (including trucks) without spark arresters, near grain or grass.

Efforts to obtain a similar order issued annually will be made by the Regional Forester.

## **COUNTIES**

### **Cooperative Fire Agreements**

Forest Supervisors will enter into cooperative agreements with Counties maintaining forestry departments.

## **FIRE DISTRICTS**

In the case of municipalities, water users, fire protective associations or others which want to cooperate in supplying additional protection, report the facts fully to the Regional Forester for advice before telling the proposed cooperator what the Service would be willing to do. (See also Par. 3, page 55-A, National Forest Manual.)

## **INDIVIDUALS**

### **Grazing Permittees**

Effective fire cooperation has been obtained in the past from grazing permittees and livestock associations. This work should continue, with added emphasis on the importance of fire control as a factor in range management.

Following are minimum requirements of grazing permittees in connection with fire control:

1. Stockmen will furnish each camp outfit with an axe and shovel.
2. They will see that their employees are careful with camp fires, and, when the conditions warrant, will furnish a suitable cook stove with fire box protected from contact with ground.



3. They will instruct their men in regard to the proper care in handling fires.
4. Where smoking is prohibited, the stockmen will see that their employees comply with the regulations.
5. They will keep the District Ranger informed of camp locations and movements.
6. They will take immediate steps to suppress fires, and will report fires either on or off the lands covered by their grazing permit.

It is the Ranger's responsibility to contact permittees upon arrival on their grazing allotment or soon thereafter, to be sure that all fire control requirements are thoroughly understood and are satisfactorily met.

### **Special Use Permittees**

All special use permits provide for cooperation by the permittees in fire control.

Forest officers should familiarize themselves with the fire requirements in these permits and reach a definite understanding with all permittees who can assist as to what they are expected to do in case of fires on or adjacent to the lands covered by the permit. Where very large numbers are involved, a special circular letter can be used to advantage to point out the requirements and to outline the expected action.

### **Land Owners**

Reports of all fires suppressed during the current fire season on the lands of The Red River Lumber Company, the Southern Pacific Land Company and the Pacific Gas and Electric Company are due in the Regional Office December 1. Outline to be followed is in Appendix 15.

## **APPLICATION OF COMPULSORY PATROL LAW**

Each Forest will, prior to the fire season, prepare a list by Ranger Districts of land owners who have not complied with the Compulsory Patrol Law. This list will include:

1. Name of land owner
2. Address—telegraphic
3. Location and area of land.

The Supervisor will furnish each Ranger with the list for his District. If a fire occurs on such lands, the owner should be *notified immediately*, if possible, and a careful record kept of the time and manner of such notification. If he cannot be notified, or if he fails to take adequate steps to control it, proceed to put the fire out. If uncertain as to the land lines or ownership, suppress the fire first and determine ownership later. Having determined the ownership of non-cooperator lands, a complete statement should be furnished the Supervisor by the Ranger, who will bill the owner for the cost of suppression of the fire.

In the event that the owner refuses to pay the bill, or does not pay promptly, refer the case, with full details, to the Regional Forester.

## PREVENTION

### PROBLEMS AND ACTION TO SOLVE

Nearly all prevention problems, even the most difficult, are vulnerable to planned attack. The following examples illustrate some of the common problems and methods which have proved successful in meeting them.

#### **Problem 1: When grazing permittee sets fire on National Forest range.**

##### *Condition*

The permittee has an established preference for 100 head of cattle. Several fires start on a brushy portion of his range distant from ranches or other habitations and following removal of his stock in the fall. They occur after a light rain and after hunting season. He was seen on horseback by two foothill residents headed toward and returning from the general direction of the fires on the day of start. No one else was seen. Fresh tracks of one horse only were found near the fire after careful search. No roads near where fire started. No lightning. Fire extinguished by crew taken in by Ranger.

##### *Preliminary Action*

The permittee, on being interviewed the next day, acknowledges being in the vicinity of the fires, but denies starting, or even seeing, the fires. States he was looking for strays. Despite his denial, he must have known of the fires, as the smoke was clearly visible over most of his range. All the evidence available is included in a complete report to the Regional Forester recommending that the permit be revoked. The Regional Forester and Assistant to Solicitor review the report.

The permittee is requested to be present at a hearing on the case. Both the evidence against him and his side of the story are discussed with him. At the hearing the permittee makes some statements that are obviously not true; he cannot explain his action in not going to the fires, and can give no evidence to lead to any conclusion but his guilt.

##### *Action Required*

The Regional Forester revokes the permittee's grazing permit for the full 100 head of cattle and notifies other Forests of the fact, so that no future application for a grazing permit will be approved.

##### *Why*

To prevent further fires from this permittee.

To emphasize responsibility of permittee independently to suppress fires on his range, as agreed to by him.

By example, to deter other stockmen from setting fires.



## *Supplemental*

The same procedure would be applicable to permittee whose employees on several occasions had been responsible for fires on his range. Lesser degrees of carelessness might call for cancellation of *preference*, or probation for the permittee. Failure to take action independently to suppress fires occurring from whatever cause on a permittee's range by the permittee or his employees would also call for cancellation of preference, or probation for the permittee. These fires would include those which, beyond a reasonable doubt, resulted from any actionable cause, such as smoking or camp fires. Similar action would be taken in the case of any other type of permittee.

In other cases, where it is reasonably certain that stockmen have been burning or have favored burning for grazing on National Forest lands and watersheds, the areas or ranges concerned may be closed to grazing under the conditions set up in Regulation G-12.

### **Problem 2: Use of no-smoking regulation to reduce smoker fires.**

#### *Condition*

Well-traveled road through a canyon, thirty miles long. Located mainly on a slope with southern exposure; crosses to other side occasionally for short stretches. Inflammable type of cover.

#### *Action*

1. Post at mouth of canyon standard "No Smoking" signs which permit smoking only at specially designated places.
2. Select locations for fag stations on a well-planned-out program which will permit frequent enjoyment of smoking by the traveling public at a minimum of danger. Utilize open places, stream crossings, etc., that can be fireproofed at low cost. Post "Smoking Permitted" and "limit" signs.

#### *Why*

To prevent starting of smoker fires by affording safe places at reasonable intervals where smoking can safely be permitted.

To make people conscious of the fact that smoking in the woods except at safe places is dangerous during the fire season.

## *Supplemental*

Fag stations should also be located along trails, at locations on construction or woods-working projects, and along heavily used fishing streams. The "No Smoking" restriction should not include areas of high elevation or other areas with no hazard.

### **Problem 3: Safeguarding a highway construction job.**

#### *Condition*

Highway location on which work is about to start traverses an area of high hazard with heavy cover which must be removed in the construction work.

#### *Preliminary Action*

A special-use permit is issued, requiring use of electric detonators; limitation of debris burning to periods approved by the Supervisor; providing of fire tools, pumpers, hose, etc.; limitation of smoking to established fag stations, and the use of the construction force for fire fighting.

#### *Action*

The Ranger visits the construction project and gets acquainted with the Supervising Engineer. Together they go over the fire prevention clauses in the special-use permit, agree on use of the construction crews on any fires in the vicinity, and on organizing the crews and providing fire-fighting tools for fires on the job.

The Ranger designates spots near the stream and has the Engineer clear them for lunch fires and smoking, posting them as fag stations.

He issues a blasting permit.

Later the engineer informs the Ranger he wants to dispose of the piled slash resulting from construction. After checking on weather forecasts, and finding that there will be no unfavorable wind or humidity conditions that night, the Ranger goes to the project, inspects the proposed brush-burning job, finds it safe to burn. He issues a burning permit. He helps the brush-burning foreman get started, and advises him how to carry on the burning job safely. He instructs the burning foreman to complete the burning job and have it mopped up by the burning period of the next day and an adequate patrol maintained.

He sends an experienced guard to the area about 10:00 A.M. to check the burning job for holdover fires and for the performance of the patrol.

Ranger periodically inspects the general project and the preparedness measures.

#### *Why*

To make sure fires will not be started during hazardous periods.

To develop a cooperative attitude on the part of the Resident Engineer by aiding him.

To obtain whole-hearted adherence to fire prevention requirements.

#### *Supplemental*

The same practice should be applied by Forest Officers in inspecting,



supervising, and offering advice and extending aid in the case of railroad rights-of-way clearing, power line construction, and all other types of construction work on the National Forest likely to cause fires.

In cases of a large volume of clearing work, or in very hazardous locations, it is necessary to provide a thoroughly experienced guard, selected and supervised by the Forest Service and paid by the construction agency, to supervise the fire organization, preparedness and fire phases of the construction work.

#### **Problem 4: Hunter Fires.**

##### *Condition*

Large influx of hunters during hunting season. No rain, normal seasonal hazard in timbered area. Limited number of roads leading into area.

##### *Action Required*

1. Train and install registrars on entrance roads near Forest boundary.
2. Stop and register hunters when entering, and issue camp fire permits if necessary. Establish personal contact, giving welcome and directions as to routes, hunting conditions, camping spots, cautions on care with fire, including distribution of appropriate literature and windshield sticker.
3. Select motorized patrolmen trained in public contact, and familiarize them with roads and camp sites in their territory.
4. Have patrolmen visit all hunter camps; check camp fire permits, methods of building camp fires; give cautions on care with fire.
5. When hunters are absent from camp, leave a friendly message urging care with fire.
6. Hunters are checked out at registrar stations when leaving Forests, data gathered on kill, deer tags validated, and thanks expressed for care with fire.

##### *Why*

To obtain care with fire and prevent hunter fires.

To create good will and foster good woods habits.

To provide a record of hunters for subsequent follow-up.

To obtain game information.

##### *Supplemental*

The Supervisor writes to each hunter on the register just prior to the next hunting season, expressing appreciation for his care the year before and inviting him to visit the Forest during the coming hunting season.

## **Problem 5: Poacher Fires.**

### *Condition*

In a fine deer country fires began to show up adjacent to certain rural communities. No lightning was reported by the lookouts in the area. No general program of work among the stockmen was going on. The hunting season was not open. The County had an ordinance against smoking in the woods.

### *Action*

The Ranger made a quiet but complete investigation and found evidence that extensive deer poaching was going on and that the fires were undoubtedly being caused by poachers smoking. The Ranger asked for authority to put on a patrolman to help to prevent smoking in the area; carried on a prevention publicity campaign in the local county papers, and got the Supervisor to arrange to have a State Game Warden come in to work on the poaching problem. Evidence was obtained to convict one poacher, and two smoker cases were successfully prosecuted. The fires suddenly ceased.

### *Why*

Persons who violate one law are likely to be careless in the observance of others. Law enforcement is an effective prevention tool.

### *Supplemental*

Similar situations are often found in rural communities where bootlegging, petty stealing, or similar crimes occur. Effort to clean out such nests by law enforcement must be vigorous.

## **Problem 6: Railroad Fires.**

### *Condition*

In a beautiful National Forest mountain canyon through which a main line railroad runs, the company has done no hazard reduction work on its right-of-way on the theory that conditions should be left as natural as possible. No fire prevention equipment, such as spark arresters, were considered feasible, because they were supposed to cut down the pulling power of the locomotives. Sanding was practiced rather indiscriminately. Fires were frequent that scarred the canyon badly.

### *Action*

Systematically dispatch section crews to all fires occurring on the right of way, making the company stand the costs. Make careful survey, showing mile by mile the essential right-of-way hazard reduction work needed, and the estimated cost of the job. Present this information to the company officials, emphasizing that they were losing much needed maintenance time of their crews, and that they are liable for damages to



Federal and private properties destroyed; that the canyon is scarred worse by fires than by well-directed hazard removal, and that prevention is good insurance because it would save them money. Request them to put arresters on their locomotive stacks, put out instructions on sanding only in prepared places, and require their men to stop throwing burning materials off trains.

### *Why*

To secure fire prevention compliance by the railroad company so the number of fires caused by their operation will be reduced.

## **Problem 7: Power Line Fires.**

### *Condition*

A main transmission line constructed under a Federal power license runs across the National Forest. This permit has the usual fire prevention clauses in it. The power line was located on the top of a ridge along which a fire break had been built and maintained by the company. This had been allowed to go without maintenance for a couple of years and a rather tall plant thrust its head up high enough so that one hot summer day when the line sagged it came close enough to the plant to set it afire. A bad fire resulted.

### *Action*

Action to suppress the fire was taken, and a thorough check was immediately made of the entire line within and adjacent to the Forest to be sure no other dangerous conditions were in existence. A damage claim was made on the company. Next year a survey was made in advance of the fire season, with remedies stated wherever required. The company was given a written report on work needed before opening of the fire season. Check was made to be sure the desired action was taken.

### *Why*

The need for surveys in advance of fire season to eliminate such hazards is essential in connection with such prolific causes of fires as power lines.

## **Problem 8: Debris-Burning Fires.**

### *Condition*

The foothills of the National Forest are pretty well settled with small ranches. These residents are none too prosperous, so must put what energy they have into trying to make both ends meet. The attitude of most of the people toward fires is apathetic.

### *Action*

The Fire Prevention and Law Enforcement Officer visits each small

ranch and talks to the residents about care with ashes and about other fire prevention matters. With the agreement of the residents, he inspects their homes for fire prevention requirements, and suggests remedies for dangerous conditions. He finds out if the people want their yards cleaned of the heavy growth of wild oats. On reaching an agreement that this is a desirable safeguard, he schedules night trips to be made by the suppression crew when the grass can be burned safely and readily.

Each resident agrees to do certain work in making fire lines around his immediate buildings, and on the dates set the suppression crew comes in and does the job of burning.

### *Why*

Friendly acquaintance with the local residents by Forest Officers has prevented many fires. Checking upon conditions of flues has brought many dangerous cases to light for correction. Cleaning and burning around buildings in country of rank annual growth is good protection against fires coming in from outside. Assistance in burning by experienced men gets the job done safely.

### *Supplemental*

Similar contacts with persons who wish to burn brush in the fall, resulting from logging or land clearing, are a good investment. Efforts should be made to get such people to dispose of the slash with a minimum of damage to standing timber and to reproduction in the case of small logging outfits. Attempt should also be made to get at least some semblance of brush piling by the demonstration method. Insist that no one burn until the fall rains come, and that this be done only under burning permit and absolute compliance with the terms of the permit.

## **Problem 9. Limited Closure of High-Value Areas.**

### *Condition*

In a watershed with highly hazardous cover is located a reservoir supplying domestic water for a large city. No other watershed of sufficient size to furnish water for impounding in a reservoir is located near this town; nor is there a second reservoir site in the watershed where the present one is located. If the brush is burned from the slopes of this drainage the life of the present reservoir would be greatly shortened, due to rapid erosion caused by the normal torrential winter rains.

This area offers the only hunting and hiking opportunities close to the people in the city.

Fires have occurred in the area during past fire seasons. Only a few privately owned lands are within the boundaries of this area.

### *Preliminary Action—Developing Public Favor*

The Supervisor calls a meeting of his advisory board of local citizens



and places the problem before them. He brings out clearly that through fast and energetic suppression work the Forest Service had held the burned area to a reasonably low acreage; that he cannot guarantee continued holding of the burned area to a low figure, since bad weather conditions, coupled with two or more simultaneous fires, might result in a disastrous fire which would ruin the watershed back of the reservoir. In that event, the reservoir would silt up, the taxes would increase if pumping from deep wells was made necessary; real estate values would drop, and the city would suffer from an inadequate supply of water.

The Supervisor outlined a plan that would prevent the fires and yet permit the area to be used by the people. The advisory board agreed to back him up by creating public support for the closure plan.

### *Action*

#### *Closure*

The Supervisor requests and obtains from the Regional Forester authority to close a described area to all public use except under written permit.

#### *Roads*

Locked gates are installed on all roads entering the area. No cars are permitted in the area unless on official business or those of residents.

#### *Hunter Camps*

Hunter camps are located in suitable places; are fireproofed and equipped with simple camping facilities, and are marked with signs.

#### *Fag Stations*

Numerous fag stations are established along the roads and trails traversing the area. They are fireproofed and signed.

#### *Registrar Stations*

Registrar stations are located at the locked gates to register all people in and out of the area.

#### *Permits*

Local ranchers in the area are given a seasonal permit to drive over the roads to and from their homes. They can do this without a permit, but the action of the Supervisor's advisory board had created a public sentiment for the closure to the extent that most everyone wants to be cooperative. All other persons, excepting Forest Officers on official business, are required to obtain a written permit from the Ranger or Supervisor before entering the area. The permit is checked by the registrar, and the party is assigned to a camp. The registrar, twice a day, notifies the Ranger of the names of the people entering the area and where they are camping.

### *Hunter Patrol*

Patrolmen are assigned to the area. They are notified twice daily where the people are camped, and make inspections of their camps, give prevention talks and watch for violations of regulations. Upon contacting a camper, the hunter patrol initials the permit.

#### *Why*

To prevent fires and preserve intact the vegetative cover of a valuable watershed.

### **Problem 10: Isolated Work Party Fires.**

#### *Condition*

A survey party will work in an inaccessible area of a Ranger District during the hazardous part of the year. After they are on the job it will be extremely difficult to contact them. The Supervisor notifies the Ranger when the party is expected to enter his District.

#### *Action Required*

The Ranger meets the party upon arrival and explains to them the prevention rules in regard to fires, camp fires, and smoking to be observed while they are in the woods. He inspects their outfit to determine if they have the necessary complement of tools, and requests the Chief of Party to instruct his men to extinguish, if possible, and report any fires found.

#### *Why*

To obtain the cooperation of survey parties in fire prevention.

#### *Supplemental*

The same procedure should be followed when other crews are working on the District during the hazardous part of the year.

### **Problem 11: Sawmill Operator Fires.**

#### *Condition*

An operator has a small sawmill located in a highly hazardous area on private land within the Forest protection boundary. He is disposing of his slabs and sawdust by burning without taking precautions against escape of fire.

The Ranger has been to see him on several occasions, and has obtained compliance with the State law in all matters relating to tools and spark arresters, but the operator has failed to correct his burning practices, even after necessary written demand from the Ranger. The Ranger has consistently refused to issue burning permit unless the operator complied with instructions. The escape of the fire would endanger private and Federal property.



### *Preliminary Action*

The Ranger interviews the magistrate having jurisdiction over the area; gives him a background of the situation; explains that to safeguard the property of others and adjacent National Forest lands, the mill operator will either have to quit burning or take the necessary precautions to prevent the escape of the fire from his burning slab and sawdust pile.

After convincing the magistrate of the importance of protecting the surrounding area from fire, the Ranger will have the mill operator brought before him.

### *Direct Action*

The Ranger informs the mill operator, in the presence of the magistrate, that he has been burning without a permit, which is a violation of Section 384, Paragraph 3 of the State law; that he cannot secure a burning permit until he has taken the necessary precautions, and that if he is unwilling to take the precautions suggested, it will be necessary to go ahead with the case.

If the mill operator is willing to cooperate, a burning permit is issued in which the conditions under which the burning may be done are outlined.

### *Why*

To eliminate the danger of fires escaping from the burning slab pile and destroying surrounding private and Federal property.

## **Problem 12: Incendiary Areas.**

### *Condition*

Numerous fires of known incendiary origin have been occurring yearly in a localized area of a Ranger District. Suspects are plentiful, but no substantiated evidence can be obtained to convict them. The Ranger believes that fires are being set for jobs and that the storekeeper does not object to the fires, since they increase his sales.

### *Action Required*

Do not hire local men suspected of incendiarism to fight fires. Import fire fighters.

Import foodstuffs for fire fighting—do not buy from local stores.

For suppression of small fires establish a suppression crew to get away from employing local men on small fires. No men suspected of incendiarism should be employed on this crew.

Employ a fire prevention law enforcement officer to investigate every fire occurring in the area, including all past fires not outlawed by the

Statute of Limitations, if there is a remote possibility of solution and conviction.

Use Forest pack stock or bring in outside pack stock when packing to fires is necessary.

*Why*

To remove one of the main motives for setting fires.

To take aggressive legal action against all incendiaries as a deterrent to setting fires.

**Problem 13: Cabin Owners' Fires.**

*Condition*

Numerous summer home cabins not under Forest Service special use permit but located in mountains are surrounded by high hazard areas. The County has well-drawn fire ordinances.

*Action Required*

Inspect the cabins for fire prevention compliance with the County ordinance, instructing the occupants, if present, what is expected of them. If they are absent, obtain their addresses and write them.

Make a prompt follow-up inspection to determine if owners have complied with previous instructions. If they have failed to comply, cite them to appear before the proper Justice of the Peace.

*Why*

To reduce the possibility of fires starting in summer cabins, and to obtain compliance by the occupants with County fire ordinances.

*Supplemental*

The same policy should be followed in special-use residence, etc., with cancellation of permit in cases where continued non-compliance is encountered.

**MAJOR PREVENTION PRACTICES DEVELOPED BY PROBLEMS**

1. Insure compliance with fire prevention and suppression requirements in Forest Service permits by:
  - a. Personal contact with permittees.
  - b. Explanation of meaning of requirements.
  - c. Explanation of advantages to permittee.
  - d. Demonstration of safe methods of handling fire.
  - e. Adequate inspection.
  - f. Administrative action on permits when necessary.
  - g. Giving fire weather advice.—Problems 1, 3, 13.



2. Reduce risks involved in industrial use by:
  - a. Extending aid in risks and hazard surveys before fires start.
  - b. Advice as to protective measures.
  - c. Explanation of advantages to users.
  - d. Getting companies to issue orders requiring care with fire on part of their employees.
  - e. Getting adoption of all possible fire safety devices or machines, such as spark arresters.
  - f. Demonstration of safe methods of using fire.
  - g. Giving fire weather advice.
  - h. Advice concerning State and Federal Laws.
  - i. Enforcement of State and Federal Laws.—Problems 3, 6, 7.
3. Reduce risks involved in recreational use by:
  - a. Personal contact and education at forest entrances and at camps.
  - b. Demonstration of safe methods of using fire (such as camp fires).
  - c. Explanation of laws and regulations.
  - d. Publicity for special requirements.
  - e. Making compliance easy and natural (fag stations).
  - f. Self inspection by Forest users.
  - g. Enforcement of State and Federal Laws.—Problems 2, 4, 13.
4. Take vigorous action to reduce number of fires incident to illegal use and occupancy of Forests by:
  - a. Careful study of the situation to identify causative agent.
  - b. Putting on of necessary protection to cover the country involved.
  - c. Taking law enforcement action not only against fire law violators but also against other types.
  - d. Get public opinion aroused against the violators.—Problem 5.
5. Get acquainted with just as many of the residents within and near the Forest as possible and show them you are willing to help them to keep their property from burning by reduction of hazards in the general interest of fire prevention.
  - a. Inspection of buildings that are in dangerous locations to see that flues, etc., are in good condition.
  - b. Advising them how to dispose of ashes and other dangerous materials.
  - c. Helping them clear dangerous fuels from around their buildings.
  - d. Advising them how and when to burn debris.
  - e. Issuing burning permits and requiring strict compliance therewith.—Problem 8.
6. Areas of extremely high public value that are natural mountain playgrounds must be given special intensive treatment to safeguard the values but still allow public use by:

- a. Arousing local public opinion as to the gravity of the situation and the need not only for control of users but also for great care in the use of fire in the area.
  - b. Invoking closure regulation.
  - c. Issuance of permits to be carefully checked, and warning users to camp only in designated fireproofed areas.
  - d. Installing sufficient fag stations.
  - e. Permitting use only of protection roads by foot or horse travelers to keep out the hordes of automobiles that would otherwise flood the area.
  - f. Putting on moving patrolmen to contact and control the campers.  
—Problem 9.
7. Get the cooperation of work parties that occupy the more remote National Forest area to do their part to prevent, suppress and report fires by:
    - a. Explaining in advance preventive restrictions.
    - b. Outlining the best ways to safeguard fires that must be used in their camps; be sure they have fire tools.
    - c. Getting their help in the direct report and suppression of fires they may discover.—Problem 10.
  8. Insure the safeguarding of particularly dangerous fire-causing agencies, like small sawmills, by:
    - a. Getting local law enforcement agencies to cooperate in punishment of violations.
    - b. Taking offenders before the magistrate when they refuse to meet the legal requirements.—Problem 11.
  9. Try to control incendiary situations that are the result of economic difficulties by:
    - a. Not hiring persons suspected of setting fires.
    - b. Importing men from outside to control all fires.
    - c. Putting on suppression crews to handle fire load.
    - d. Buying supplies from outside sources on such work.
    - e. Hiring no pack stock locally.—Problem 12.

## HAZARD SURVEY AND PLAN

Survey of hazard and plan for elimination or reduction will be made on each Forest and filed in the fire atlas.

- a. Character, length or number and location of *all* removable hazards.
- b. The means to remove or reduce hazards.
- c. Years or, where the job is an annual one, months each will be done.
- d. Who will do the jobs.
- e. Special facilities needed to handle.
- f. Date of accomplishment.



Plans should be brought up to date annually prior to the opening of the summer field season.

## **SPECIFIC MEASURES FOR PREVENTING OPERATING AND STRUCTURAL FIRES**

Definite measures of proved merit are covered in the following pages :

### **SPARK ARRESTERS**

Such equipment is standard for flues in all Government buildings in hazardous areas during the fire season. They should be installed before the beginning of the dangerous period.

All tractors in use during the fire season in dangerous areas must have effective spark arresters at all times.

### **PATENT FLUES**

All joints and bases of patent flues should be laid-up in fire clay or cement, thus sealing the terra cotta flue. The purpose of the shell of galvanized iron which is held in place by spacers is to carry off the heat radiating from the terra cotta and not to care for sparks and smoke that might escape.

Current check should be made of all flues to be sure they are spark tight.

### **LIGHT FUSES IN AUTOMOBILES**

In cases of emergency, automotive equipment can be operated with burned-out light fuses by bridging the contact with tinfoil or wire, but this does not eliminate the short which caused the original trouble. Cars should not be left with the emergency bridging in place. Prompt steps should be taken to have the basic trouble cleared up and the fuses replaced.

### **FIRE EXTINGUISHERS**

Each occupied house, warehouse, or other structure must have either a five-gallon water pack can filled and on the wall ready for use, or a regular fire extinguisher. Fire extinguishers of the type requiring recharging must be recharged annually and labelled with the date. Other types should be checked periodically to see if they have been depleted by use or leakage and prompt steps taken for refilling or necessary repair.

### **CAPS AND FUSE**

No caps and fuse shall be used by National Forest crews in hazardous areas during the fire season or be permitted by agencies over whom the Service has authority.

## MOTOR EQUIPMENT

### *Trucks*

Will be equipped with a serviceable axe and shovel.

### *Passenger Cars*

Will be equipped with serviceable axe, shovel and water bag or one-gallon canteen. Where available, small extinguishers can be installed, but will not be bought specially.

### *Trucks Hauling Explosives, Gasoline or other High Inflammables*

Will carry one and one-half quart chemical extinguisher, checked at frequent intervals as to serviceability. Will be labeled with explosive signs.

### *Solvents or Water Spray*

Will be used in cleaning all machinery—never gasoline.

### *Welding*

Will not be done in the field without having an extinguisher and a filled backpack pump at hand.

## POWER LINES

Power lines constitute a particularly dangerous fire risk and hazard, especially during high winds.

There is no uniform Regional rule for clearing, because of the many variations in cover and topography encountered along lines. The following are minimum requirements, both for Federal power licensees and for all lines under permit:

1. Make an annual survey, preferably with a representative of the operating company, to appraise hazards and risks on the lines.
2. Make a written program for the abatement of hazards and risks needing action, sending three copies to the Regional Forester and one to the local representative of the power company concerned. A map showing work needed will be helpful. Special attention should be paid to:
  - a. Insufficient clearance that might result in setting fires.
  - b. Need for clearing around poles enough to catch falling insulators. Clear ten feet in radius for 11,000 volts and less, and a minimum of twenty feet around higher voltage poles.
  - c. Need for complete clearing of rights-of-way throughout entire distance across National Forest land to specified widths. This should be required only where the Supervisor can show it is a reasonable and worthwhile requirement. The width should be kept as low as will meet the needs.



## POWER LICENSES

Every Federal power license should contain the following stipulations:

1. Licensee shall clear and keep clear to adequate width its lines on Federal lands to the satisfaction of representative of Commission.
2. Licensee is liable for injury to or destruction of buildings, roads, trails, lands, or other United States property occasioned by the construction, operation or maintenance of its project.
3. Licensee shall do everything reasonably in its power and require its contractors to do everything independently and upon request of United States representatives to prevent and suppress fires on or near land occupied under the license.
4. Licensee shall maintain project in adequate, efficient, and safe operating condition.

The following table shows common power line failures, proposed remedies and clauses under which action can be taken:

| Difficulty                            | Remedy   | Stipulation<br>Applicable |
|---------------------------------------|--|---------------------------|
| Birds.....                            | Requires company to install tower guards.....  | 3 & 4                     |
| Blasting.....                         | Require burning permits in fire season .....   | 3 & State Law             |
| Broken insulators.....                | Company should inspect currently and replace.....  | 3 & 4                     |
| Broken lines.....                     | Reconstruct lines to strengthen.....   | 4                         |
| Clearance inadequate..                | Install additional towers or poles; cut trees or brush.....  | 1 & 3                     |
| Fallen poles or collapsed towers..... | Replace rotten poles; strengthen towers.....   | 4                         |
| Falling trees or snags.               | Get company to cut identified threats. Impress liability of company for damage to Federal property ..... | 2 & 4                     |
| Flash-overs.....                      | Additional poles or towers.....  | 3 & 4                     |
| Fuses, burning.....                   | Require replacement open fuses with better type.....   | 3 & 4                     |
| Shorts.....                           | Replace faulty insulators and remove fallen trees or improve clearance .....                             | 3 & 4                     |

Re-energizing lines in attempt to clear the trouble when lines have been blown down or broken by heavy winds is very likely to cause fire. Un-

willingness on the part of the company to shut off current in high voltage lines under which a fire is being fought endangers the fire fighters. In such cases as these local pressure must be brought to bear to obtain compliance on the grounds of public safety, and with the definite understanding settlement for damages will be sought where such failures by the Company cause losses to Federal property.

While the license does not cover clearing on privately owned lands occupied by the power lines, there are certain articles in the license which may be used to influence the licensee to remedy hazardous condition on such stretches. Under one of the articles in the license, the licensee has assumed full liability for injury to or destruction of property of the United States occasioned by the construction, maintenance or operation of the project work. Another article requires the licensee to do everything reasonably within his power to prevent and suppress fires on or near lands occupied under the license. Determine definitely the conditions which constitute fire hazard or risks on the privately owned sections of the transmission line right-of-way which may endanger National Forest lands in case of fire. Based on such determination, the licensee can be informed that it will be held liable under certain articles of the license for damages due to a fire which could have been prevented by elimination of the hazards.

## **RESPONSIBILITY OF OTHER AGENCIES**

### **STATE HIGHWAY COMMISSION**

The State Highway officials have recognized their responsibility to eliminate hazards along the main-traveled roads of the State Highway system. Much can be done locally in getting the interest of the Division Engineers to work on areas of greatest danger after funds are granted for such action. Technical advice and assistance can be rendered by the local Ranger and his guards to see that the available funds cover the largest possible mileage of dangerous roads and that safe practices are followed on the jobs.

### **RAILROADS**

No State law requires the railroads to do prevention work, but definite steps can be taken to minimize the danger of fires starting from this cause. These are:

- a. Where new construction is on National Forest land, include needed fire stipulations in the permits.
- b. Where fires are caused by railroads use their crews to the limit in suppressing them.
- c. If Federal property is damaged do everything possible to force adequate trespass settlement.



- d. Make an annual survey of hazards, preferably with representative of railroad on rights-of-way by mile posts, with recommendations of control work to be done and estimated cost.
- e. Submit this to Company officials and get them to see the wisdom of abating the hazards along the rights-of-way, to eliminate threats (b and c above). Give them technical advice and incidental supervision on actual jobs.
- f. On the same basis, get adequate spark arrester installation, sanding limitation, etc., recognized as essentials and adopted.
- g. Under State law, installation of signs against throwing burning material from train platforms can be insisted on.
- h. After program of prevention is started never let it stop.

## **LAW ENFORCEMENT**

### **ACTION REQUIRED**

All Forest Officers should have copies of the booklet "Law Enforcement on National Forests, California Region," and should familiarize themselves with the material therein, and consult it in case of difficulty or doubt.

Investigation on every actionable man-caused fire will be carried to the point where it is established definitely that evidence for a prosecution exists or that no case can be worked up. In cases of trespass, similar action is essential.

Local prosecutions will be handled in the Justice Courts, and Federal cases will be reported to the Regional Forester, in triplicate, for action.

Form 618-B should be prepared immediately when a case is settled in court, with one copy sent in to the Regional Office.

See Appendix, Guard Section, for Summary of Laws and Regulations.

### **HAZARDOUS FIRE AREAS**

Under the hazardous fire area law (Cal. Sta. 1929, Ch. 115), on petition of over 50 per cent of the owners, or agents of owners of land, any area of not less than 10,000 acres can be declared by the State Board of Forestry as a hazardous fire area for a specific period. Supervisors can sign as agents for all Federal lands. It is unlawful for anyone to smoke or build a camp fire in these areas except at established camp grounds. Notices must be given by posting of signs not further than one-third mile apart along boundaries and along roads and trails in the area.

Petitions should be sent to the State Forester signed by the necessary land owners:

1. Defining area by natural boundaries, roads, etc.
2. Show area.
3. Show area owned or controlled by each owner.

4. State nature of hazard.
  5. State period for closure desired.
- Annual designation is required.

## **SMALL SAWMILLS AND LOGGING OPERATIONS**

Where, after due warning, compliance with the State fire laws is not promptly made, legal action should be taken to require the immediate elimination of the dangerous conditions.

### **Burning Permits (Paragraph 3, Sec. 384)**

Should be issued in all cases of burning of mill sawdust or slash, with clauses in the permit requiring the clearing of all fuel within a radius of at least 100 feet and the installation of an effective protector to surround the burning piles. One adult person should be in attendance at all times when mills are not in operation, and large accumulations should not be burned. Do not permit burning unless the above is complied with.

### **Spark Arresters (Paragraphs 7 and 9, Sec. 384)**

Should be required on all stacks from which sparks are emitted. Gasoline or oil burning engines must be equipped with effective arresters when operating near grass.

### **Clearing Around Machines, and Supplying Tools in Logging Operations (Paragraph 10, Sec. 384)**

Falling of snags and clearing away of rotten logs within certain distances from machines is required. Fight-fighting tools also are required.

### **Blasting**

Permits are required for blasting in logging during the burning permit season except in the redwood area.

## **CLOSURES**

Under the Secretary's Regulation (T-1, I) the Regional Forester has from time to time closed certain National Forest areas to public use, except under permit, when extremely hazardous conditions justified such action. This authority has been used sparingly because of its drastic nature.

In general, the closure authority should be invoked where a careful analysis of the situation shows beyond question that this is the only way in which full control of fire-causing uses can be secured. Closure is expensive, because generally special men must be put on to make it effective; it is difficult to enforce on account of its restrictive character; it is unpopular, because it is a limitation on the free enjoyment by the public of the National Forests.



# **PUBLIC CONTACT METHODS**

## **CHECKING STATIONS**

Locate with following principles in mind:

1. Keep to lowest number, giving maximum attention to those leading to areas of high fire hazard.
2. Put on straight-aways without grade and where visibility both ways is good.
3. Reduce to minimum the interference with through, high-speed travel on highways.

Careful selection and thorough training of men, including CCC enrollees, who are to handle the checking, is essential.

Enough men on shifts to cover fourteen hours a day will normally get 90 per cent of the travel.

Methods to be followed must fit conditions and cause least interference with public travel but still get the data wanted and put across the desired fire prevention warning.

Proper housing of checkers is very important to give the right impression to travelers.

## **SIGN POSTING**

Fire signs will be posted only on main roads in National Forests at or close to entrance or at main intersections, where large "CAMP FIRE PERMITS REQUIRED, NO SMOKING, CAMP AND PICNIC FIRES, SHOVEL AND AXE, and NO FIREWORKS" signs should be displayed to warn the public of the restrictions in effect on the area being entered.

On more infrequently traveled side roads and trails, restrictive signs will be placed only where such roads or trails leave main routes of travel or where trails branch. Put all signs together at such places.

The above does not apply to special signs of regulation, such as "Closed Area, No Camping, Smoke Here," which must be posted wherever needed.

## **CAMP FIRE PERMITS**

The following agencies only will issue camp fire permits:

1. All classes of Forest Service employees.
2. All designated representatives of California State Department of Natural Resources.
3. California State Automobile Association, Automobile Club of Southern California, National Auto Club, National Park employees, local City Fire Departments and similar officials, State Chamber of Commerce, Department of Conservation, main and sub-offices.

## **PUBLICITY**

One member of the Forest organization should be assigned the job of seeing that the local newspapers get accurate and complete reports on all fire matters that are of interest to the public. This is particularly important in connection with restrictions that may be put into effect, and with law enforcement cases. It is also essential that accurate reports giving the real conditions on large fires be put out currently to avoid common inaccuracies and exaggerations.

When Ranger Districts are isolated from the main body of the Forest, the local District Ranger should handle the job directly with his papers in the interest of speed in capitalizing on news value.

## **FIRE STATISTICS AND FOREST FACTS**

Each guard should be supplied by the Supervisor with a concise but complete set of statistics and facts with respect to the National Forest in which he is working, for his own information and in order that he may be in a position to answer questions asked by Forest visitors. This can well be built up in the question and answer form of the "Forest Ranger's Catechism."

## **RULES OF THE GAME**

Laws, regulations, policies and rules affecting what can be done and how to do it, what cannot be done and why, are scattered in manuals, handbooks and circular letters.

The following section codifies and briefs the rules that are an integral part of fire control.

## **GENERAL POLICIES**

### **ATTACK ON FIRES OUTSIDE OF THE NATIONAL FOREST PROTECTION ZONE**

Fires will not be attacked initially by the Forest Service outside of its protection boundary unless (1) fires are where our forces can get there first or (2) it is good business to do so as a matter of self protection. Agreements drawn up with the State Rangers and cooperating Counties should be in line with this principle.

Under the agreement with the CCC Taylor grazing authorities, we are bound to attack, on request of proper authorities, fires within these areas which we can reach before their CCC forces.

As a general guide, Forest Service suppression forces, such as CCC crews, will not be sent to fires over 25 miles outside of National Forest protection boundaries. The Regional Forester will authorize exceptions to this



where very serious conditions exist and it seems to be clearly in the public interest to do so.

## **ATTENDANCE AT FIRES**

### **Supervisor, Assistant Supervisor and Fire Specialist**

The Supervisor, Assistant Supervisor or Staff Fire Specialist will go as soon as possible to all fires attaining Class C size, to be sure adequate plans are followed to control such fires during the first burning period and within reasonable area and cost limits. They should observe carefully what goes on, and take steps to see that prompt corrections are made where needed; also train the man in charge in better practices. They should inspect a reasonable number of going fires of other sizes to check on the action taken and in the interest of developing the best possible methods of attack and control.

### **District Rangers**

District Rangers will go at once to all fires on their Districts starting in particularly dangerous country. They will go to Class C fires reported on their Districts as soon as possible, and in the event two are burning at the same time, put the more dangerous one under control, then proceed to the other and take similar action if control has not already been effected. They will check control action on all fires on the District handled by guards or outsiders, or have a qualified alternate do so within twenty-four hours after they are reported out, unless dangerous conditions make this impossible, or fires occur at such isolated places as to make travel time to reach them obviously out of reason. Checks should be made in detail of the suppression action taken, and violations of principles of good practice will be discussed with the responsible officers to avoid future similar mistakes.

### **Assistant Rangers**

Assistant Rangers will be sent to as many fires of all classes as possible, on their own or adjoining Districts, in the interest of increasing experience and to provide broad training in fire suppression work.

## **DISCIPLINE**

High standards of conduct are required of all members of the guard force. Strict compliance with the requirements in the Fire Plan is expected, and failures to live up to its terms should result in prompt action to eliminate the individual from the organization.

## **EMERGENCY GUARDS**

The material strengthening of most Forest protective forces during the past couple of years should mean that few such men will be needed. Their use must be limited to real cases of urgent need based upon inception and

translation hazard. Advance authorization for the hire of emergency guards for periods in excess of three days should be requested.

## FIRE INSPECTION FREQUENCY STANDARDS

The Supervisor or his assistant will inspect each protective man, including suppression crew, at least once during the fire season. The District Ranger or his assistant will inspect each protective man and crew at least once each month during the season. He must also see that pumping equipment is thoroughly tested weekly.

## SMOKING BY FOREST SERVICE OFFICERS

As an example to Forest visitors and users, all Forest Officers will refrain from smoking during the closed period while travelling through the Forests, except at places of habitation, at improved camp grounds, in posted smoking places, or at elevations where smoking is permitted. This means that smoking on hazardous State highways and County roads will not be practiced, even where no County ordinances to the contrary are in effect.

## AIRPLANES AND POLICY REGARDING USE

Airplanes will be made available on contract and should be used for the following purposes when conditions justify:

1. *Scouting* specific areas following electrical storms. Requests from the field for airplane scouting should define the specific area or areas which it is desired to have covered. A plane can cover about 200,000 acres with one flight. This fact should be kept in mind when making requests, and the areas about which there is greatest concern should be specified.
2. Transportation of fire suppression overhead.
3. Transportation of limited quantities of fire tools and other equipment when needed to meet first work period control requirements.
4. Transportation of special fire equipment for dropping directly near fires in inaccessible country when necessary to meet control time objective of the Chief's policy.
5. Making reconnaissance of large fires whose boundaries are not accurately known, to determine facts of value in planning control action; also for first examination after subsequent extended runs in drainages not readily reached by ground scouts.
6. Flights for observation during periods when heavy smoke interrupts lookout service.

*Landing field data—Air Patrol—due May 1st annually*

Maps in triplicate showing all landing fields on or adjacent to the Forest



which may be used during periods of fire emergency will be submitted by May 1st annually to the Regional Office.

A list will be submitted with the maps giving the following information :

Name of field

Standard of emergency field

Breadth and length of runway

Elevation of field

Location of field (Section, Township and Range)

Location with respect to some prominent landmark

Other pertinent information

## **USE OF REGULAR AND EMERGENCY CREWS ON FIRE IMPROVEMENT CREWS**

Men engaged on improvement work will be hired with the definite advance understanding not only that they will do all in their power directly to prevent and suppress fires, but also that they are an integral part of the fire control organization. They will observe and help to enforce all of the fire laws and regulations; will be subject to emergency calls at any time, and must observe the Forest's instructions as to standing by and providing notification of points where they can be reached when they are on approved absences from duty.

### **Place in Fire Organization**

#### *Location*

Improvement crews can be made an important part of the protection force, particularly in isolated areas of low man-power, where they can be scattered out on work, such as trail maintenance, to serve as first attack on lightning fires. Truck trail construction crews should be used to build projects during the fire season that will provide the best distribution of suppression forces where this does not mean too great a sacrifice in project priorities.

#### *Selection*

Foreman and crews must be hired with the fire suppression work clearly in mind. All men selected should be able to stand the rigors of fire fighting, and the foreman must be experienced in such work.

### **Communication and Transportation**

Each crew will be connected up by radio or telephone at all times during the fire season. Transportation facilities to promptly move the crews off the job and to fires must be provided.

#### *Tools*

Each crew will have ready for instant departure the needed fire tools,

lights, bedding, other equipment, and emergency food supplies separate from project stocks. Where trucks are available, such fire equipment should be kept in a special box.

### *Training*

All men in the crews who are fitted for overhead positions on fires will attend the guard training camps. The crews will be given training on fires and the instruction needed to handle them expeditiously as units.

### *Plans*

Each crew will be given written instructions as to its place in the fire organization, as well as outlining in detail its fire duties.

### *Use*

Improvement crews will be the first line of attack in areas adjacent to their work. They will follow CCC crews on call to more remote fires.

### **Subsistence when Held in Camp**

Where such crews (not CCC or ERA) are held in camps on Saturday afternoons, Sundays, or holidays because of critical fire conditions, they will not be charged board. The appropriation from which they are paid will stand the cost.

## **CIVILIAN CONSERVATION CORPS (CCC)**

### **Labor Policy**

Maximum use of CCC forces, including those of cooperators, will be made before outside labor is hired. Ordinarily, such men will not be transported over 100 miles. Special provision for comfort of the men on long trips will be made. Forests will deal with each other for their CCC men and with cooperators as specified in the agreements with each.

### *Local Labor*

Labor of this kind will be hired on the following principles:

First. Specially qualified local men whose reliability and experience are unquestioned.

Second. Locally organized crews using first the ones of greatest value, such as lumberjacks and section crews rather than box factory, fruit pickers, etc.

Third. Organized crews from a distance.

Fourth. Pickups as a last resort. Comb these over carefully and do not take anyone onto the job who is not well equipped and physically fit. Other kinds are a liability.

### **Use of Enrollees in Fire Control Positions**

Enrollees should not be used in guard positions for which regular funds (not FF) have been set up.



## **Hours of Work and Standby**

Camps are subject to emergency calls at any time, day or night. The hours of work on emergency jobs will be set by the work agency after consultation with the Company Commander, with due regard to the health of the enrollees.

During critical fire conditions, as determined by the District Ranger or other responsible Forest Officer, the Project Superintendent will hold all or part of the men in camp on non-work days or after regular work hours, subject to call for fire emergencies.

## **Recuperation Periods**

The intention of the recuperation period policy is to authorize only such rest time as is actually needed for recuperation following extra strenuous exertion or long hours of fire suppression work. The following rules apply:

- a. Must not exceed the actual overtime put in, or off-duty time worked.
- b. The maximum time that can be granted, regardless of overtime put in, is two work days. Each Saturday, Sunday or holiday coming within a recuperation period will be counted as four hours of recuperation.

Examples:

1. Two days' time are due; recuperation period starts Saturday morning, will close so man goes to work Tuesday morning.
  2. One day or less due; period starts Saturday morning; work is resumed Monday morning.
  3. Six hours due; recuperation starts Sunday noon; resumes work Monday at noon.
- c. Within the limitations in (a) and (b), the amount of recuperation time to be allowed shall be determined by the Company Commander, in consultation with Superintendent, with the object of granting what is really needed in view of the kind of work and the hours put in.
- d. Rest time will not be allowed for standby, except in cases specifically authorized by the District Commander, because of repeated demands of this nature.

## **Food Supplies Furnished**

Occasionally the Forest Service furnishes food supplies for use by enrollees on suppression work or at side camps where Army supplies are not obtainable, or in addition to those furnished by the Army. If the latter cannot make reimbursement for this additional food, the cost must be met out of funds other than CCC.

## **Special Shoes for Enrollees**

When shoes with composition soles rather than hobnails are preferred for fire duty, local Supervisors should ask Company Commanders to obtain them.

## **Debris Clearing Along Highways**

On Forest Highways already turned over by the Bureau of Public Roads, CCC crews can be used to clear up debris on strips bordering sections within or close to the Forests, either to abate hazards or to improve their appearance whenever the priority of the work justifies. Crews must not replace regular labor that might be hired if funds are available.

### **EMERGENCY RELIEF ADMINISTRATION (ERA)**

When ERA relief rollers are used on fire fighting, they can be paid out of FF at regular rates only for hours in excess of the amount of time they are authorized to put in on their ERA jobs. The eight-hour day and period limitations do not apply to fire suppression work.

If there is danger of incendiary trouble arising from ERA workers in following the above policy, they can be reduced by the amount of excess hours they work on fires in the ensuing month so the total for the two months will be what it would be normally.

Under the emergency section of the Executive Order, ERA men could be worked as long as necessary on fires without extra pay, though this is not good practice.

In case of Blister Rust Control or other ERA crews of like status, all of the fire fighting done can be paid for by the Forest Service out of F.F. It does not affect their relief status, and if the men can get in their full time on the other work, with due respect to existing limitations, they can be allowed to do so.

### **WORKS PROGRESS ADMINISTRATION (WPA)**

WPA workers who are drafted for fire suppression will not be paid or subsisted by the WPA during their absence from the projects.

Unless the men are away on fires for more than three days, work assignments will continue in force. On longer assignments work orders will be cancelled and reassigned when the men return.

Where men volunteer from WPA projects to fight fire, their status is the same as though the men separated themselves to do any other kind of temporary work.

The above applies to camp projects as well as to other types.

### **NATIONAL YOUTH ADMINISTRATION (NYA)**

If youths who are turned over to us by NYA are taken to fight fires, they are considered as no longer employed by NYA while so engaged. The entire responsibility for their pay and compensation rests on the Forest Service during these periods.



# USE AND CARE OF FIRE TOOLS AND EQUIPMENT

Fire tools and equipment are supplied for fire use only, and must be held only for such uses.

## RADIO

The use of Forest Service instruments is limited strictly to:

1. Emergency calls from points without regular telephone service.
2. For intermittent contacts with mobile crews.
3. For connections with points impracticable to connect by telephones because of topographic barriers.
4. To connect points occupied so infrequently that investment in wire communication is plainly unjustified.
5. Very infrequent contacts between Supervisor's office or other distant points not connected by satisfactory commercial lines, but only when such calls are clearly justified as not violating the spirit and intent of our authorization, which contemplates radio use as a supplement and not a substitute for commercial facilities.
6. Connections with CCC or other temporary camps for which no other means of contact are available, and where costs of lines clearly not justified.
7. Point-to-point contact in the frequency band 2900 to 3500 kilocycles on general administrative business is not permitted, since these bands are required primarily for fire communication.
8. Only written messages should be transmitted, except for short test calls and for official communication back and forth between overhead men on going fires.
9. No authorization will be given for any outside agency or person to use frequencies assigned to the Forest Service; nor will other than Forest Service sets be operated on our frequencies.
10. No changes will be made in any Forest Service radio equipment without advance approval of Regional Forester and the Chief, Forest Service.

## SLING PSYCHROMETERS

Sling psychrometers have a very practical value and use on fires. Where local Weather Bureau units are not on the ground, psychrometers should be made available and used by all men in charge of large fires to determine at frequent intervals the changes in relative humidity. Control plans should take these changes into consideration as a vital factor in the behavior of fires.

## FLAME THROWERS

The flame thrower is a dangerous tool in the hands of inexperienced men, but can be used with almost entire safety by trained men.

The following conditions govern its use:

- a. It must not be used by CCC enrollees.
- b. No outfit should be used without the new check valve in the cap.
- c. Use only oil-resistant rubber composition gaskets on valves.
- d. A gasoline proof packing is the only one that can be used in the pump. Belmont 6100,  $\frac{1}{8}$  inch or similar.
- e. It must be kept tight to prevent leakage.
- f. Do *not* use *gasoline* in it under any circumstances. Kerosene, saw oil or fuel oils can be used safely.
- g. Be careful not to get oil on the outside of the container in filling.
- h. No one with oil on his clothes should get near the flame.
- i. Inspect periodically to be sure outfit is in shape.

## FLARES

Every truck operating on any highway in California after night must have two flares, warning lights or reflectors available to place 200 feet to the front and rear at all times when such vehicle is disabled on the highway. Flares are approved and should be requisitioned for use on all Forests, except the four Southern ones which are to use either reflectors or small electric lanterns. The latter will be bought locally, but flares can be obtained through Procurement.

## MACHINERY ON SUPPRESSION

Experience in the Region has shown clearly how effectively machinery, such as trailbuilders, can be used in fire suppression. In planning control operations, whenever the size of the job justifies, the possibility of using machinery must be given full consideration early in the game. The fire boss must put in his order to have the machinery delivered to the lines in time to handle as much of the job as is most suitable to machine work. This is particularly necessary in heavy brush cover where the unit of accomplishment by man-power is low.

Definite plans to transport and use such equipment already on or close to the Forest, including that owned by private agencies and by the State and Counties, and the Regional standby machinery, should be made as part of the Forest preparedness measures.

Standby machines will be made available for rental at locations listed in the Annual Regional Emergency Plan.



## **TOOLS AND EQUIPMENT AT UNOCCUPIED STATIONS**

To prevent theft of tools and equipment and to lessen the likelihood that isolated stations will be broken into, all small tools and equipment ordinarily will be removed when such stations are closed for the winter. This is not necessary where the cost and effort of packing tools in and out is greater than any possible loss.

See to it that all equipment and tools that will rust are given a protective coating against rust when left in an unoccupied station over winter.

## **GOVERNORS ON CCC TRUCKS**

All trucks in CCC service must be equipped with governors unless exempted by the Regional Forester.

Fire suppression trucks will be relieved of this requirement on a showing of need. Recommendations should be made to the Regional Forester giving official numbers of trucks involved, their locations and the reasons.

## **FISCAL**

### **USE OF FIRE FUND**

F. F. will be used only :

1. To pay salaries and expenses of such positions or extensions of positions in the regular protective short-term force as may be authorized in advance by the Regional Forester.

2. To cover the salaries and expenses of Emergency Guards put on to handle actual emergency conditions.

3. To cover replacement men needed to take the places of men assigned to fires.

4. To cover the wages of all special schedule project men used, who are not financed as part of the regular Forest force on a year-long basis.

5. To pay for the repair and operation of all motorized or other large equipment used on fires if bought from F.F., P.&A. or Coop.; if bought from other funds can include depreciation also.

6. Extraordinary inter-district travel by Rangers or inter-Forest travel by Forest staff.

7. To pay clerks needed to clean up Forest fire accounts.

8. To cover all fire suppression costs, including the reconditioning of tools damaged on fires if local forces cannot do jobs, and such tools or equipment as may be ordered for use on actual fires, but not for subsequent replacement of tools lost or worn out on fires, except for maintenance costs of fire stocks above the normal annual depreciation.

## NET WAGES OF PROTECTIVE FORCE

Salaries to be paid new men without experience :

|   | Per Month |
|---|-----------|
| Lookouts, Firemen, Patrolmen, of average responsibility.. | \$95      |
| Registrars, of average responsibility.....                | 95        |
| Patrolmen, below average responsibility.....              | 90        |
| Registrars, checkers, below average responsibility.....   | 90        |
| Suppression crew men.....                                 | 80        |

Rate each job and pay the man the salary that fits the job. Do not pay any man more than the rated salary for the job he is holding.

Annual increase of \$5.00 per month can be made to men for each year of service until they reach the rate set for the job each is holding.

Because of the limitation on increases, the salaries of many men were badly out of line by 1936. Increases of \$10.00 per month were approved for men who had enough years of service to have reached the rate set for the job they were holding, if they were \$20.00 or over out of line, until they got up to within \$10.00 of their proper rate, after which time they go up \$5.00 a month. Men \$15.00 or less out of line go up \$5.00 a month.

### WAGE RATES

A circular is put out annually by the Regional Forester which specifies the maximum rates to be paid to all classes of protective positions, including fire fighters.

No Guard will be paid over \$135, net, without prior approval of the Regional Forester.

### PURCHASE OF FIRE TOOLS OUT OF CCC FUNDS

CCC Funds cannot be used to outfit fire control warehouses or tool caches erected out of CCC.

### CCC RATIONING POLICY

#### Increased Ration Allowance

The value of the regular ration can be increased by the District Commander not over 10 per cent for CCC men engaged in fighting fires. The increase is obtained by the Company Commander on his request, supported by a certificate of a Forest Service representative as to the number of men and hours involved. Increase above 10 per cent can be approved by the Ninth Corps when the District Commander can show the absolute necessity for this.

#### Responsibility of Feeding CCC Men and Army Personnel

The Army is financially responsible for the full ration cost of all CCC enrollees and Army personnel while fighting fires.



## **Responsibility for Feeding Civilian Men, Including Overhead**

The Forest Service is financially responsible for feeding all men not enrollees or Army personnel. The Army will mess such men in its fire camps, but the Service must reimburse the Army for the actual cost of all meals served to them. Such men include overhead and men from cooperating agencies other than CCC, facilitating personnel of cooperating CCC companies, our hired fire fighters and overhead. Costs will probably run around 60c or a little less per day.

## **Establishment of Separate Rationing Facilities**

If the Army will not or cannot handle the messing of our employees, then the Forest Service will establish and operate its own kitchen separate from the Army.

## **Procedure for Reimbursing Army**

The Company Commander of the designated rationing company will submit a certified invoice, in triplicate, to the Supervisor of the Forest on which the fire was fought within ten days after the evacuation of the fire camp. The invoice will cover the value of the rations used; the number of meals served; the number served to Forest Service employees; the total cost of such meals, and the amount of reimbursement claimed. (See Appendix 8 for form.)

The Supervisor will audit the invoice carefully, and, if he approves it, will prepare and send in a voucher on Form 1034 chargeable to FF in favor of the Company Commander, CCC District Supply Officer, or other Army officer designated as payee. *Word vouchers exactly as follows—put nothing else on them:*

For meals served to Forest Service employees hired for fighting forest fires in accordance with certified invoice attached.

## **Policy on Fires Outside N. F. Protection Boundaries**

The policy outlined applies only where CCC men and Forest overhead suppress fires handled by the Service within or threatening the protection boundaries of the Forests. The Service will not be responsible for rations on fires for which it is not the suppression agency.

## **Payroll Preparation**

Make deductions of 5c per hour for fire fighters as heretofore, since the probable total cost will be close to that figure on a twelve-hour basis.

## **PROPERTY LOSSES BY ENROLLEES**

Company Commanders will make deductions on the payrolls for enrollees who negligently lose or damage Government property on fire work on a proper showing of justification by the Forest Service.

## GUARDS—HOLIDAYS AND LEAVE

### Saturday Half-Holidays

Fire suppression forces are not entitled to Saturday half-holidays. Guards also should be hired with the understanding they will only get such time off or compensatory time as can be granted at times of low fire danger.

### Leave

When Guards who have annual leave due them are dismissed for cause, a payroll should be submitted for their payment up to date of discharge, with a recommendation whether or not leave should be granted, so final decision can be rendered by the Secretary of Agriculture, who is the only one with jurisdiction. Money to cover the leave in case it is approved must be held.

## DEPOSITS OF REPAYMENTS OF COSTS INCURRED AGAINST FF

Such repayments will be considered a credit to the appropriation from which paid, and will be so deposited. This permits the crediting as repayments to appropriations of fire-fighting costs on fires outside of the Forest which are paid back by the State, County, or other agency. The same can be done on fire costs repaid by lumber companies for fires on non-cooperating areas such as operating areas.

## DEPOSIT OF FIRE TRESPASS COLLECTIONS

All collections in fire trespass cases, both of suppression costs and damages, must be deposited as "Miscellaneous Receipts," and none can go as reimbursement to an appropriation.

## INCLUSION OF CCC IN TRESPASS COSTS

While no authoritative decision on this question has yet been rendered by the courts, the time of CCC men should be included as an item of damage in fire trespass cases at the rate of \$1.50 per day. Man-days should be computed in the regular manner for charging the time of CCC men when engaged in fire work involving overtime.

## EXPENSES OF TRESPASSERS BEFORE U. S. COMMISSIONERS

Where it is necessary to take a trespasser before a U. S. Commissioner, his expenses will be paid by the Forest Service *on regular expense account* up to the time he is turned over, but not beyond that point.



# REPORTS AND RECORDS

## INDIVIDUAL FIRE REPORTS

These should be prepared in triplicate, one copy for the Ranger, one for the Forest Supervisor, and one for the California Forest and Range Experiment Station at Berkeley. Retain the latter in the Supervisor's Office until called for by the Station. It should then be posted as to cost and damage, and forwarded promptly.

## LARGE FIRE REPORTS

Special telegraphic reports on large fires costing over \$500 to suppress or burning over 500 acres should be sent in daily to the Regional Forester until these are controlled. Serious smaller fires or concentrations should also be reported. Night wires should be sent unless reports on late afternoon conditions can be mailed in time to reach the Regional Office the next morning. Report: name, location, cause, size, weather, losses, number of men, cost, date expect to control, injuries, and any other points of special interest.

## EXTRA PERIOD FIRES

All fires around which a control line adequate to check or stop their advance has not been completed before 10:00 A.M. of the day following discovery will be reported as Extra Period.

If a fire is corralled before 10:00 A.M. of the day following discovery, but a live, *unworked* spot fire is discovered *after* 10:00 A.M., the original fire must be reported as Extra Period.

As to lightning fires, whenever a lookout man sees flame or smoke and the fire is found afterward, the observance of the flame or smoke constitutes discovery. If no live fire is found where the flame or smoke was seen, no fire is reported.

The following standard reasons for Extra Period Fires:

1. Lookouts spread too thinly.
2. Other fire personnel spread too thinly.
3. Detection failures due to smoke or fog.
4. Out of season—guards off.
5. Failure of Forest Service personnel (yearlong).
6. Failure of Forest Service personnel (guards).
7. Failure of cooperator.
8. Failure to recognize emergency conditions.
9. Failure to handle removable special danger.
10. Failure to use speediest methods.
11. Failure to use speediest equipment.
12. Inadequate planning of attack.

13. Insufficient night work.
14. Start from large fires outside (not threatening in early stages).
15. Inaccessible areas, lack of roads or trails.
16. Remoteness from labor supply.
17. Lightning fire—could not be found, despite prompt and sustained search.
18. Other.

In using the above reasons when determining why a particular fire became "extra period" use only one caption. Do not place "yes" after several captions. In your narrative report for each fire, you should enlarge on the *one reason* that in your opinion resulted in the fire becoming extra period.

### **GUARD RATING**

Each Guard will be rated by his immediate superior at the close of his period of employment on regular forms prescribed for the purpose. (See form in Appendix 2.)

## **APPENDIX 1**

### **REGIONAL BOARD OF FIRE REVIEW OUTLINE**

#### **1. CHARACTER OF SEASON**

Discuss severity of season compared to other recent years, as to number of man-caused and lightning fires, number of extra period fires with reasons therefor, rate of spread, length of season, peaks of extreme danger within season, etc.

#### **2. MAN-CAUSED FIRES**

Compare for entire Forest, with segregation by Ranger Districts, number of man-caused fires by classes and causes with at least five previous years. Use graphs to show trends, if possible. Where material variations in numbers and causes of classes occur, give brief explanation.

#### **3. LIGHTNING FIRES**

If any one storm caused 25 or more fires (or a smaller but unusual concentration), describe mobilization of organization to handle and follow-up by regular force. Give results.

#### **4. PREVENTION MEASURES**

Discuss:

- (a) Effectiveness of prevention measures in force, such as: No smoking, fag stations, closures, hazard reduction, hunting registration, etc.
- (b) Other measures proposed for ensuing years to meet problem.



(c) Was a current analysis of prevention problems made and action taken? What were the special problems, and what did you do about them?

(d) Law enforcement record as compared with that of past two seasons, with particular reference to classes of cases where increased trouble developed. Include a comparison of smoking and similar regulation violation cases where these are material in number.

## 5. EFFECT OF INCREASED SHORT-TERM FORCE

Discuss :

(a) Percentage of fires detected first by lookouts as contrasted with record before system was intensified.

(b) Shortened travel time to fires in specific cases.

(c) Cases where crew attack held fire small which, with 1- or 2-man attack, would probably have become large.

(d) Closer contact with travelers because of more men in the woods.

(e) Communication improvement with better and more telephone lines.

(f) Additional needs in man-power or facilities not now covered.

## 6. SUPPRESSION OF LARGE FIRES

Bring out in discussion specifically :

(a) Fire conditions at time of start and outline of initial plan of action, including location of control lines where it was expected fire would be held. Subsequent changes in strategy as they were developed.

(b) Scouting. How was this handled? Was it adequate to keep men in charge advised of conditions? Were maps used? Was radio used?

(c) Numbers of men and overhead needed for the jobs at hand and steps taken to realize these objectives. Give by periods. Were these short, adequate or excessive?

(d) Men in charge of fire by periods, with sector and division boss assignments.

(e) Location of camps. Travel time from camp to fire job. Size of camps.

(f) Effectiveness of labor. Did it get onto lines by daybreak and before dark? Was it adequately supervised and directed? How many men per chain of line were available?

(g) Use of previously prepared lines in campaign. Were they in shape to use? If not, what should be done?

(h) Amount of line produced per unit of man-power, patrol, mop-up, back-of-line forces, line construction forces.

(i) What was the length of line produced per unit of man-power employed on actual line construction? Do not include patrol, mop-up, camp men, etc. ; include only men engaged in line construction.

(j) Beginning with a certain number of men for a line construction job, what was the percentage of loss of man-power to accomplish line construction due to dropping men out for patrol and for mop-up?

(k) What percentage relationship existed between the "back-of-the-line" forces and the line forces, *i. e.*, did it take 20 men back of the line to keep 80 men on the line? This would be 20 per cent back of line to 80 per cent on line. Do not consider men who are off shift.

(l) Line lost. Reasons. Was it backfired? Were torches used?

(m) Use of airplanes, tankers, trailbuilders, radio?

(n) Mopping up and patrol organization. How was this handled? How many men per chain of line were out each period of this work? Were they effective? Were there too many on the job at night to supervise properly to really get effective work?

(o) Cost of fire by classes of activities. (As segregated in Block Q, Form 929.)

(p) Estimated damage.

(q) If you had the job to do over, what would you do that was not done or what change would you make in the action taken? Why did the fire become as large as it did? What could have been done either to have prevented it entirely or to have held it to a Class B or small C fire at the worst?



# APPENDIX 2

## GUARD PERSONNEL RECORD

### UNITED STATES DEPARTMENT OF AGRICULTURE GUARD PERSONNEL RECORD REGION FIVE

----- FOREST, DATE -----

1. NAME ----- (PRINT) ----- (LAST) ----- (FIRST) ----- (MIDDLE) ----- PHONE -----  
HOME ADDRESS ----- (STREET) ----- (CITY) ----- (STATE) -----  
NAME AND -----  
ADDRESS OF PERSON TO BE NOTIFIED IN CASE OF DEATH -----

2. DATE OF BIRTH (MONTH) ----- (DAY) ----- (YEAR) ----- SINGLE ----- MARRIED -----  
NUMBER OF DEPENDENTS ----- CITIZENSHIP (FULL, FIRST PAPERS OF ALIEN) -----

3. WAR VETERAN ----- SERVICE (ORGANIZATION-NAVY, ARMY ETC) ----- (PERIOD) -----

4. EDUCATION: GRAMMAR ----- HIGH SCHOOL ----- COLLEGE -----  
(YEARS COMPLETED) (YEARS COMP) (CRSE) (DEGREE) -----  
SPECIAL TRAINING -----

5. PRINCIPAL EMPLOYMENT OTHER THAN FOREST SERVICE -----  
-----  
-----  
-----

6. JOBS HELD THIS YEAR ----- PAY RATE ----- MOS. -----  
-----  
-----

7. RATING ON JOB HELD THIS YEAR UNDERLINE ABOVE AVERAGE,  
AVERAGE, BELOW AVERAGE

8. CHECK MAN ON THE FOLLOWING POINTS

|                               | ABOVE AVE. | AVE. | BELOW AVE. |
|-------------------------------|------------|------|------------|
| INDUSTRY                      |            |      |            |
| DEPENDABILITY                 |            |      |            |
| JUDGEMENT                     |            |      |            |
| INITIATIVE                    |            |      |            |
| ABILITY TO HANDLE SMALL CREWS |            |      |            |
| " " " LARGE "                 |            |      |            |

9. IS RE-EMPLOYMENT RECOMMENDED IN WHAT POSITION -----  
-----

10. REMARKS:

REPORTING OFFICER ----- TITLE ----- DATE -----  
APPROVING OFFICER ----- TITLE -----

## INSTRUCTIONS FOR USE OF GUARD PERSONNEL RECORD

- a. Use form for all Guards.
- b. Fill out items 1 to 5 inclusive at time man is employed. Hold in file.
- c. Promptly, on termination of service, complete other items and send one copy to Supervisor, who will keep in an alphabetical file by years, or, if preferred, in one master alphabetical file.
- d. Under item 8, rate men only on those elements which their employment has tested. Do not rate on "ability to handle men" unless the employee actually has handled men during the period of employment covered in this report.
- e. Under item 10, if man is discharged give date of release and brief reasons for action. Record the descriptive comments that help in placing a man. Often a briefer sentence, or even a descriptive term, tells as much about a man as all the rest of the rating.
- g. Make certain of correctness of name. It is preferable to give first name in full and middle initial. Well-established nicknames may be given in parentheses as an aid to identification, but should not be used in lieu of first name.



## APPENDIX 3

# INSTRUCTIONS FOR GIVING AND RATING McARDLE EYE TEST

Give on level, open ground out of doors.

### Equipment needed

1. A piece of wallboard or similar material 22 x 36 inches, covered on one side with percale or other dull black cloth.
2. A small metal disk painted flat black with a  $\frac{3}{8}$ -inch hole, backed with two or three thicknesses of *clean* white cloth. Solder a small pin to the back of disk so that the disk can be fastened temporarily to the cloth panel.
3. Stakes set at each 25-foot interval as test line between 300 and 550 feet.

### How to give test

#### STEP 1

Give in full sunlight and have observer face the sun, but do not let the direct rays of the sun hit the panel front during test.

#### STEP 2

Agree on certain simple signals between observer and examiner to mean specific things.

#### STEP 3

The examiner sticks the white spot on the black cloth chart twelve inches in from one end of panel, holding this shoulder high and with white spot toward examiner.

#### STEP 4

Man to be tested walks 300 feet away, turns, and if he can see the white spot, he walks 50 feet further and tries again. Continue this until spot is barely visible to him. This is his limit of vision.

#### STEP 5

Signal for a check test by the examiner at final limit.

#### STEP 6

Examiner reverses panel and can either leave spot where it is, put it on the opposite end, or take it off.

#### STEP 7

If wrong answer is given to test, have man move in until he can see and give right answer. Repeat test to determine man's maximum distance of view beyond a doubt.

Caution : Do not let man tested stare at panel too long. Continued search does not help.

This test is based largely on *size* of object—that is, how far distant an object of standard size can be seen.

The usual test for color blindness should always be given in addition to this suggested test for power of vision so that data for a study on the effect of color blindness on detection may be gathered.

APPENDIX 3

FOREST

EYESIGHT TEST RECORD AND RATING  
(MCARDLE METHOD)

| NAME | MAXIMUM DISTANCE WHITE SPOT SEEN             |                    |                    |                    |                    |                  | VERIFICATION<br>OF TEST |          |   |
|------|--|--------------------|--------------------|--------------------|--------------------|------------------|-------------------------|----------|---|
|      | LESS<br>THAN<br>300'                         | 305'<br>TO<br>350' | 355'<br>TO<br>450' | 455'<br>TO<br>500' | 505'<br>TO<br>550' | OVER<br>550'     |                         |          |   |
|      | RECORD ACTUAL TEST DISTANCES<br>AND RATING † |                    |                    |                    |                    |                  | O.K.                    | IN ERROR |   |
|      | POOR   | FAIR               | AVER.              | GOOD               | VERY<br>GOOD       | EXCEP-<br>TIONAL |                         | +        | - |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |
|      |  |                    |                    |                    |                    |                  |                         |          |   |

DATE

REPORTING OFFICER

† RECORD TESTS IN NEAREST FIVE-FOOT DISTANCES ESTIMATING THIS BETWEEN 25 FOOT STAKES.



# APPENDIX 4

## PREPARATION OF TEN-DAY FIRE REPORT

### Dates due

Mail without fail on 10th, 20th and last day of each fire month, starting May 10.

### Points to watch in preparation

Make your reports accurate. Include figures for fires occurring *within protection boundaries only* in Columns 1, 2, 3, 4, 6, 7, and 8.

### Additional suggestions

#### COLUMN 1

Keep records on reportable fires outside protection zones worked on to substantiate FF charges and for preparation Form 924-W. Do not include such fires in this column.

#### COLUMN 5

Include only National Forest land damages. Figure no damages at less than \$1.00 per acre.

#### COLUMN 6

Study extra period fire definitions and include nothing but fires that qualify.

#### COLUMN 8

Include only civil and criminal cases initiated. Do not show those settled by administrative action.

#### COLUMN 9

Include *vouchered* items only.

#### COLUMN 10

Give total cumulative expenditures, including legitimate FF tool and equipment purchases.

#### COLUMN 13

Include here only:

- a. Men actually hired to cover emergency situations.
- b. Men in authorized protection force paid out of FF.
  1. While on regular protection jobs.
  2. While fighting fire but replaced by another man not already covered by fund allotment or FF authorization.

Do not include men authorized to be paid out of FF while they are fighting fire *without replacement*. They are fire fighters for that period.

Do not include replacements for regularly paid guards while the latter are fighting fire. Such men should be paid as fire fighters.

COLUMN 13(a)

Be sure to cover period from *July 1* on.

COLUMN 13(b)

This is the total calendar year figure.

COLUMN 14

List by classes of employees, such as 400 CCC; 100 ERA; 50 regular.

COLUMN 15

Include P. & A. and cooperative prevention employees only, not FF employees, who show in Column 13(d).

GENERAL

- a. Show in footnote number CCC guards and those paid from ERA on duty last day of period. Do not report CCC suppression crews as guards if they do 20 hours' or more project work weekly. This class of men must not be used to replace protection men regularly financed.
  - b. Give concise statement of conditions and outlook.
  - c. Round off all figures to nearest whole number.
  - d. On reverse side of form report changes, causes, acreage, and cost of all reportable fires fought in whole or partly outside of the protection areas by the Forest Service.
  - e. On the last ten-day report for each month show in a footnote the number of employees paid from FF for 88 hours or more during the month, *i. e.*, "FF fire fighters....."
- (month)

(number)

APPENDIX 5

PREPARATION OF FORM 924-W, SHEETS 2a-8b

In preparing the Annual Fire Report (Form 924-W) make sure that all columns are checked carefully and that the totals on certain pages agree with totals on other sheets carrying the same information with different classes of lands.

SHEETS 2(a) TO 4(b) INCLUSIVE

Combine area burned and values. Sheet 3(a) is a total of the Sheets 2(a) and 2(b). Sheet 4(b) is the *grand total* sheet for this group, and should equal the totals of Sheets 3(a), 3(b) and 4(a). The total columns and each *individual* column should be checked.

SHEETS 5(a) AND 5(b)

Areas burned, by causes—columns must agree with respective area columns in Sheets 2(a), 2(b), 3(a), 3(b), 4(a), 4(b).



## SHEETS 6(a) AND 6(b)

Damage by causes, in dollars, must agree with the respective "value" columns in Sheets 2(a), 2(b), 3(a), 3(b), 4(a), 4(b).

## SHEETS 7(a), 7(b) AND 8(a)

Must agree as to total number of fires in each land class, *i. e.*, National Forest Land, Other Land Inside National Forest, Protected Outside, etc.

*Sheets 6(b), columns 10, 20, and 30, and 8(a), columns 10, 21 and 32,* are not to be used, since there are no "unknown" fires.

## SHEET 8(b) SUPPRESSION COSTS—DOLLARS

*Column 2.* Enter the total direct cost to the Forest Service of fire suppression labor paid from FF and Deposited or Undeposited (obligated) Cooperative funds. Include here the wages and expenses of emergency (FF) guards while engaged in fire suppression; also the temporary labor cost to the Forest Service of false alarms, non-reportable fires (including temporary labor FF expenditures on State and outside land), clerical time, etc., in connection with suppression. Show CCC labor separately in parentheses valued at \$1.50 per day.

*Column 3.* Enter the FF and Deposited or Undeposited Cooperative costs to the Forest Service of subsistence supplies furnished by the Forest Service on reportable, non-reportable, and other outside fires. Do not show cost of emergency rations here.

*Column 4.* Enter the direct cost from FF and Deposited or Undeposited Cooperative money for other supplies and equipment due to fighting reportable, non-reportable and outside fires, toll calls, etc., in connection with suppression. The warehouse charges for miscellaneous fire supplies distributed currently to the Forests should be included in this column. Semi-expendable and non-expendable equipment charged to suppression will also be shown here. Include also FF suppression expenditures made by R.O. and charged to Forests. The FF and deposited Cooperative expenditures for equipment maintenance and repair (other than transportation equipment) when used in connection with reportable, non-reportable and outside fires should be entered in this column. Do not include value of S&E additional stock requisitions.

Deposited Cooperative cost of replacement requisitions, both annual and current, should be shown in this column. CCC charges are generally not shown in this column. If found necessary, submit a reason therefor.

*Column 5.* When transportation equipment is used in connection with the suppression of reportable, non-reportable, outside fires and false alarms, and a direct FF or deposited cooperative expenditure is involved, show in this column. Show CCC expenditures in parentheses.

*Column 7. (Should equal sum of columns 17 and 18, Form 930, Sheet A.)*

Enter here *contributed* salaries and expenses of regular year-long force (including clerical time) charged to suppression; also *contributed* salaries and expenses of all *regular* short-term guards paid from both P&A and deposited cooperative funds charged to suppression. Emergency guards on *suppression* are not to be considered as "guards" but as fire fighters paid from suppression funds, and their wages and expenses while engaged in fire *suppression* should be included under "temporary labor," column (2).

*Column 8. (Should equal column 14, Form 930, Sheet A.)*

This column is total of columns 2, 3, 4, 5 and 7.

*Columns 9, 10, 11.* Distribution of suppression costs on basis of area of each class of land burned should be made by individual fires, including prorated charges. The total of these three columns should equal column (8).

*Columns 12, 13.* Enter here, differentiating between labor and other, the value of "Free Cooperation" and any other cost *not* paid from Forest Service, deposited cooperation or undeposited cooperation. The sum of these two columns is the same as column 16, Form 930, Sheet A.

*Column 15.* This column equals column (8) minus column (7) unless deposited cooperative funds are involved in column (8), then it equals column (8) minus column (7) minus the total of deposited cooperative funds involved in column (6).

*Column 16.* Total repayments may involve repayment of salaries and expenses of regular year-long and short-term Forest Officers, direct repayment to the FF account. Both should be included here. Repayments involved here are in connection with *suppression only*.

*Column 17. (Is the same as column (15), Form 930, Sheet A.)*

This column equals column (8) minus column (7), also minus the value of all suppression costs paid from deposited or undeposited cooperative funds in column (6); also minus the value of the repayments to the FF account included in the repayment item in column (16). This column then equals column (15) of Form 930, Sheet A, or further explained as being equal to column (14), Form 930, Sheet A, minus columns (17), (18) and (19) of same sheet.

*Column 18.* Include only guards financed from FF funds. This column should be the same as column (31) of Form 930, Sheet A.

In addition:

1. Number of fires on Form 924-W must agree with number shown on Form 930.
2. Column (17), Form 924-W, Sheet 8(b), plus column (19), Form 930, Sheet A, equals column (6), Form 924-W, Sheet 8(b).



# APPENDIX 6

## PREPARATION OF FORM 930

### SHEET A

The sheet should be made up by calendar years and copies filed in both the Supervisor's and the Regional Forester's offices on or before February 1 each year.

Include all reportable fires. (See Form 929 for definition of "non-reportable" fires.)

Round off *all* figures to the nearest whole number.

For definitions of "Regular," "Short term," "Guard," etc., see the Fire Glossary.

#### COLUMN 1

The two lines provided for "Objective" and "Previous acreage" will not be used in this Region.

#### COLUMNS 2, 4, 6 AND 9

The date for these columns will be taken from Forms 924 and 929. Enter "First Period" fires in column 6. Enter "Extra Period" fires in column 9.

#### COLUMNS 3, 5, 8 AND 11

Enter total cost of fires by classes from Form 19-h (*including* repayments and semi- and non-expendable fire equipment purchased from "FF" and "Coop.>"). The value of "Free Cooperation" and other costs *not paid* from Forest Service, deposited or undeposited (obligated) cooperation should be excluded and entered only in column 16.

To get the direct costs to the Service subtract all repayment items from the grand totals.

#### COLUMNS 7 AND 10

Enter gross areas burned by these classes of fires inside the National Forest protection boundaries. Taken from Form 929. Use Form 924 figures for area burned within National Forest boundaries, against which costs in column (15) should be compared.

#### COLUMN 12

Includes Forest Service costs of false alarms, non-reportable fires, clerical time, toll calls, etc., in connection with suppression. Warehouse charges for miscellaneous supplies, other than equipment, should be distributed currently and the costs included in this column if not prorated against actual fires. Semi-expendable and non-expendable equipment charged to suppression but not charged to individual fires will also show here. If all

suppression costs not charged directly to fires and false alarms are prorated against them this column will include the same amount as is entered in column (20). Prorate costs, including depreciation, maintenance, etc., to fires, and do not show large amounts of undistributed costs here.

#### COLUMN 13

The sum of columns (2), (4), (6) and (9).

#### COLUMN 14

The sum of columns (3), (5), (8), (11) and (12).

#### COLUMN 15

Special suppression costs equal column (14) minus the sum of columns (17), (18) and (19). Represent suppression costs to the Service exclusive of contributed salaries and expense of regular employees and guards.

#### COLUMN 16

Enter here the value of "Free Cooperation" and any other costs *not* paid from Forest Service, deposited cooperation, or undeposited (obligated) cooperation. The data for this column are from the "memo" columns of Form 19-h or from Form 929.

#### COLUMNS 17, 18, 19 AND 20

These columns are a memorandum of certain suppression costs included in column (14). For greater detail, see Annual Fire Report. Emergency guards on suppression are not to be considered as "guards" but as fire fighters paid from suppression funds. Entries for these columns are defined below.

Emergency guards are all guards paid from FFF. All other guards are classified as regular.

#### COLUMN 17

Enter here contributed salaries and expenses of the regular year-long force (including clerical time) charged to suppression. Get figures from Forms 19-h or 34-a.

#### COLUMN 18

Enter contributed salaries and expenses of all regular short-term guards (suppression only) paid from both "P. & A." and cooperative funds. Secure from Forms 19-h and 34-a.

#### COLUMN 19

Enter here only the value of suppression costs paid from *deposited* or *undeposited* cooperation *except* the salaries of regular short-term guards paid from cooperation and included in column (18). Include here the value of FF repayments which were indirectly included in column (14). Figures come from Form 19-h or 34-a.



#### COLUMN 20

Enter the cost of all false alarms and non-reportable fires included in column (14). Take Forms 19-h.

#### COLUMN 21

Salary and expenses of regular year-long force, including clerical time for preparedness only, excluding prorated forage and other similar prorated charges. Data will come from expansion accounts kept on Form 21-i for Activities No. 38, Prevention, and No. 39, Presuppression, and Forms 34-a.

#### COLUMN 22

Salaries and expenses of all regular short-term guards charged to Preparedness. Data will come from expansion accounts kept on Forms 21-i for Activities No. 38, Prevention, and No. 39, Presuppression, and Forms 34-a.

#### COLUMN 23

Salaries and expenses of all Emergency Guards, charged to Preparedness. Data will come from expansion accounts kept on Forms 21-i for Activities No. 38, Prevention, and No. 39, Presuppression, and from Forms 34-a.

#### COLUMN 24

Include all *other Preparedness* expenditures to Activities No. 38 and No. 39, such as wages, hauling, freight, *expendable* supplies and equipment, emergency rations, etc., made during the calendar year. Data will come from expansion accounts kept on Forms 21-i for Activities No. 38, Prevention, and No. 39, Presuppression.

#### COLUMN 25

Includes semi-expendable and non-expendable equipment charged to Activity No. 35—Fire Equipment during the calendar year not included in suppression costs. Do not include fire equipment purchased from "FF" and "Coop.," which was charged on individual fire records, Form 19-h, and reported in column (14) as suppression costs. The Regional Office will inform each Forest of the amount of P. & A., or other funds, they may expect for their annual additional stock fire requisitions. In addition include the value of other equipment as indicated above.

#### COLUMN 26

The sum of columns 21, 22, 23, 24 and 26.

#### COLUMN 27

Column (26) minus the sum of columns (21) and (28).

It is Preparedness costs to the Forest Service exclusive of contributed salaries and expenses of regular year-long employees.

## COLUMN 28

Memorandum record of Deposited and Undeposited cooperative funds spent on *Prevention* and *Presuppression* during the calendar year, including repayments. Data from Forms 19-h set up for suballotment control of cooperative funds, and from repayment items affecting Prevention and Presuppression. Do *not* include repayments due to *suppression* in this column.

## COLUMN 29

Memorandum record of time and expenses of guards contributed to suppression and all activities other than preparedness. This will be the sum of Columns (30) and (31), minus the sum of Columns (22) and (23).

## COLUMN 30

Gross cost of the entire guard force, including salaries, expenses and subsistence *during* the *fire season* and training period only, regardless of the allotment from which paid; include time and expense contributed to other activities, but exclude guards paid from FF, who will be reported in column (23). When regular guards change to emergency guard status they should be charged from that time as emergency guards in column (23). This will include training period salaries, etc., for improvement crews and prospective emergency guards to the extent paid from protection funds. Include here gross salaries and expenses of "Suppression Squads" paid from other than FF and regularly held waiting for fire calls. Data will be secured by analysis and segregation of the time and expenses of regular short-term fire guards, as may be entered on such Forms as 19-c, 19-d, 19-f, 19-h, and 34-a, depending upon where the records of such gross expenditures are maintained.

## COLUMN 31

Gross salaries, subsistence and expenses of all emergency fire guards during the "emergency" and training period only, except when on suppression, in which case they will be paid as "fire fighters" and the costs reported under suppression. Data from Forms 19-c, 19-d, 19-f, 19-h, and 34-a, in the same manner as for regular short-term guards.

## COLUMN 32

The sum of columns (14), (21), (24), (25), (30), and (31), minus column (18). Time of guards on suppression is included in both columns (14) and (30); this duplication is overcome by deduction of column (18).

## COLUMN 33

The sum of columns (15), (18) and (27).

## COLUMN 34

Memo of costs of airplane hire for all protection purposes. These costs



are also included, as prorated, in columns (14) or (26). Regional totals will be sufficient. The record of these costs may be obtained from Regional Office disbursement records.

#### COLUMNS 35 AND 36

Are for statistical information as to (1) the maximum number of fire guards employed at any one time and (2) the number of fire guard man-months employed during the period for which costs are reported in columns (30) and (31). "Suppression Squads" regularly held waiting for fire calls paid from other than FF will be included as "Regular Guards." If Suppression Squads are paid from FF while awaiting fire calls they will be included as "Emergency Guards." Obtain from same source as "costs" or payrolls and time slips.

#### COLUMN 37

Maximum number of temporary fire fighters on duty at one time. Need not be exact number but should be close. Obtain from temporary payrolls or time slips.

#### GENERAL

Where a Forest spends FF, deposited or undeposited (obligated) cooperative funds suppressing fires on other Forests, the other Forests should be advised so they may include such charges in their Forms 924-W and 930-A-N.

#### SHEET B

Show CCC costs in parentheses. The total number of man-caused fires on this sheet should equal the sum of man-caused fires on Sheets C-D and J.

#### SHEETS C-D

Indicate the maximum number of emergency guards (guards paid from FF), the maximum number of regular and temporary forces (exclusive of telephone operators), the maximum number of improvement and other crews (*CCC men in parentheses*), and the number of year-long Forest Officers (exclusive of clerical) available for fire duty. The sum of the total number of fires should equal the number on Sheets A and J.

#### SHEET K

Read instructions on back of sheet carefully before working up this sheet.

Indicate the number of cases pending and show the disposition of those cases indicated as "pending" the year previous.

#### GENERAL

Forms 930, A-N series, should be worked up very carefully and all columns checked and cross checked before submission. They must be typewritten.

# APPENDIX 7

## DAMAGE APPRAISAL INSTRUCTIONS

The Chief's instructions of April 27, 1925, and subsequent instructions are briefed in the following.

When making damage appraisals in connection with large fire trespass cases, refer to special instructions issued for this specific purpose.

Instructions contained in the following paragraphs are for preparing damage sections of Forms 929-B-C and 930.

There are two essentials in fire damage appraisals :

1. Adequate estimates of physical losses.
2. Record of losses in usable form.

### DAMAGE, CLASS B AND C FIRES

For lands other than National Forest estimate accurately as possible without detailed examination.

For National Forest land :

A. *Estimates.* Ocular estimates are satisfactory unless very high values are involved, in which case make accurate appraisals.

B. *Values.* The following values will be used :

1. Protection Forest, Woodland, Brush Areas.  
Give a value of \$1.00 per acre. No value for timber or reproduction killed.
2. Woodland ; \$1.50 per acre.
3. Pure grass areas will not be included in column (b) of Forms 929 B-C, unless it is desirable to give such areas a protection value of \$1.00 per acre. (This may be done when they have watershed values.) Such areas should be included in column (a) of Form 929 B-C, as should also sagebrush and like areas, unless classified as protection brush.
  - a. Forage. Figure damage to forage only when the fire measurably affects the handling of livestock on the range. Local rates will be used. The values for forage will be entered in Block G (6), Form 929 B-C.
4. Improvements. Actual sale value of property destroyed.
5. Recreational. Disregard for the present.
6. Game. Disregard for the present.



7. Stumpage. Prices applicable to merchantable timber killed.

|                      |            |
|----------------------|------------|
| Ponderosa pine ..... | \$4.50 MBM |
| Sugar pine .....     | 6.00 MBM   |
| Douglas fir .....    | 2.50 MBM   |
| White fir .....      | 1.50 MBM   |
| Red fir .....        | 1.50 MBM   |
| Incense cedar .....  | 1.50 MBM   |

8. Value per acre of young growth:

Ponderosa Pine

| Age                    | Good Sites |       |       | Medium Sites |      |       | Poor Sites |      |       |
|------------------------|------------|-------|-------|--------------|------|-------|------------|------|-------|
|                        | 20         | 40    | 60    | 20           | 40   | 60    | 20         | 40   | 60    |
| Timber Type            |            |       |       |              |      |       |            |      |       |
| East side .....        | 3.50       | 7.50  | 17.50 | 3.00         | 6.50 | 13.50 | 3.00       | 5.50 | 11.50 |
| Mixed conifer .....    | 4.00       | 11.50 | 31.00 | 3.50         | 9.00 | 22.50 | 3.50       | 7.50 | 15.50 |
| White and Red Fir..... | 3.00       | 7.00  | 17.00 | 3.00         | 6.00 | 13.00 | 2.50       | 5.00 | 9.50  |
| Lodgepole .....        | 2.00       | 3.50  | 7.50  | 2.00         | 3.00 | 6.00  | 2.00       | 3.00 | 5.00  |
| Douglas Fir .....      | 3.00       | 8.00  | 21.50 | 3.00         | 7.00 | 17.00 | 2.50       | 6.00 | 12.00 |

Instructions:

- Determine type and site.
- Ascertain age classes of young growth destroyed.
- If natural reproduction can be expected use the above values, except that:

Where there are *more* than 100 young trees per acre before the fire, and less than 100 trees per acre alive after, the full figures above will be applied.

Where the number of young trees per acre alive after the fire exceed 100, *no* damage will be *reported*.

Where the number of young trees per acre before the fire was less than 100, *no* damage will be reported even though all are destroyed.

- If planting will be necessary to restore forest, add \$5.00 per acre to above values.

C. *Types*. The following types will be recognized in Fire Damage appraisals. Based on number of trees over 12 inches d.b.h.

- Ponderosa Pine East Side*. Ponderosa pine or Jeffery pine comprises 50 per cent or more of stand.
- Mixed Conifer*. Mixed stand in which sugar pine is the key tree, forming 15 per cent or more of the stand, and in which yellow pine and incense cedar are its usual associates. Other species found in this type are Jeffery pine, white fir and Douglas.
- White and Red Fir*. Either one or both of these species comprise 75 per cent or more of the stand.
- Lodgepole*. Fifty per cent or more lodgepole.
- Douglas Fir*. Sixty per cent or more Douglas fir.

6. *Protection Forests*. Stands at the upper limit of tree growth, timber usually poor form and small size. The principal species are red fir, Shasta fir, white fir, lodgepole, white bark pine, western white pine, foxtail pine, and mountain hemlock; chaparral and non-timbered brush are also considered *protection forest*.
7. *Woodland*. Open stands of short, bunchy trees at the lower limits of tree growth. Types classified as follows:
  - Piñon-Juniper
  - Juniper 80 per cent plus
  - Oak 60 per cent plus
  - Digger pine 60 per cent plus
8. *Barren*. Grass, sagebrush, and similar types.

#### D. *Site Classes*

1. *Good*. Ten per cent of dominant mature trees exceed 150 feet in height.
2. *Medium*. Ten per cent of dominant mature trees are from 125 to 150 feet in height.
3. Ten per cent of dominant mature trees are less than 125 feet in height.

NOTE: For immature stands, assign sites represented by adjacent virgin forests.

E. *Mapping of Types*. Preparation of topographic maps is not essential. Major types should be distinguished and mapped as follows:

1. *Timber lands*
  - a. Old growth, segregating principal types.
  - b. Young growth which will not restock naturally, including restocking burns, cutover areas, and second growth.
  - c. Young growth under mature timber.
2. *Protection forest*
  - a. High altitude non-commercial forest.
  - b. Chaparral and non-timber brush.
3. *Woodland*.
4. *Barren, grass, sagebrush, and similar types*.

#### F. *Mapping of Areas*

1. Show area of entire burn, including private land.
2. Show National Forest and private land; area inside and outside of National Forest boundary.
3. For timber land and protection forest show:
  - a. Area completely killed.
  - b. Area partially killed.



On protection forest and non-timbered areas only, enough ground should be covered to map the area and determine major timber types.

### G. *Cruising*

1. For merchantable timber and young growth areas on National Forest land, a *five* per cent cruise (one strip, one chain wide, per 40) will be made. Strips need not be run in cardinal direction, but should be planned to gridiron the burn effectively. When complete or nearly complete destruction of timber resulted, the cruise can be made immediately after the fire. When partial killing occurred, particularly in ponderosa pine, the cruise should not be made until late fall.
2. When most or all of the timber is killed, tally separately dead and live trees by diameter breast height. Take measurements of merchantable height as well as diameter, and use available volume tables to determine the volume—using site classifications. With partial killing, tally separately dead, live, and doubtful trees. The latter are defined as trees with crowns not consumed by fires, but browned except for small parts. The number of these that will die is estimated to be 50 per cent.

# APPENDIX 8

## CCC REIMBURSEMENT FORM

### U. S. FOREST SERVICE

To....., Dr.

Forest.....

.....  
(Name of fire)

.....  
(Date)

- a. Value of rations taken to fire area originally.....\$.....
- b. Value of rations received in fire area from District Quartermaster .....\$.....
- c. Value of rations purchased in fire area.....\$.....
- d. Value of rations returned from fire area.....\$.....
- e. Value of rations consumed on fires.....\$.....
- f. Total number of meals served; includes meals of CCC enrollees, Army overhead, civilian fire fighting, Forest Service overhead, overhead of cooperating agencies, and other cooperators.....
- g. Value of each meal based on the total number of meals served .....\$.....
- h. Number of meals served Forest Service employees.....
- i. Total cost of meals served Forest Service employees.....\$.....
- j. Amount of reimbursement to the Camp Commander of the messing company claimed from Forest Service....\$.....

I certify that the above bill is correct and just, and that payment therefor has not been received; also that reimbursement is claimed at actual cost of meals furnished.

Signed.....

Company Commander

(Send in triplicate to Supervisor)



## APPENDIX 9

### DUE DATES FOR REPORTS FROM SUPERVISOR TO REGIONAL OFFICE

|                        |  |
|------------------------|--|
| January 15.....        | Power pumper report  |
| February 1.....        | Form 930, A-N  |
| May 1.....             | Landing field report   |
| May 12, 22.....        | Ten-day fire reports   |
| June 2, 12, 22.....    | Ten-day fire reports   |
| July 2, 12, 22.....    | Ten-day fire reports   |
| July 15.....           | Expenditures of FF for period January 1 to June 30<br>(see page 58-A, National Forest Manual)                                  |
| August 2, 12, 22.....  | Ten-day fire reports   |
| September 2, 12, 22..  | Ten-day fire reports   |
| October 2, 12, 22..... | Ten-day fire reports   |
| November 12.....       | Ten-day fire reports. Final report unless fire season<br>not over  |
| November 12.....       | Annual deficiency estimates  |
| November 15.....       | Extra period fire report   |
| November 20.....       | Annual fire requisition  |
| November 30.....       | Report on State fires  |
| December 10.....       | Result of fire cooperative campaign<br>Annual report of fires on Red River, Southern Pacific<br>and Pacific Gas & Electric Co. |
| December 31.....       | Annual fire report, Form 924-W   |

## APPENDIX 10

### REGION 5 CARDBOARD FIRE AND CAMPING SIGNS AND FORMS

| Number                   | Title   | Size    |
|--------------------------|---|---------|
| Number                   | Title   | Size    |
| Number                   | Title   | Size    |
| <b>CAMP FIRE PERMITS</b> |   |         |
| P-14                     | Camp Fire Permits Required.....   | 17 x 44 |
| R-15                     | Camp Fire Permits Issued Here.....  | 7 x 14  |
| R-16                     | Camp Fire Permits Issued Here.....  | 17 x 44 |
| <b>CAMP FIRES</b>        |   |         |
| R-2                      | Camp Fires Prohibited Here.....   | 7 x 14  |
| R-9                      | Camp and Picnic Fires Permitted only at Designated<br>Picnic Grounds..... | 17 x 44 |
| R-10                     | Picnic Grounds—No Fires or Overnight Camping..                            | 7 x 14  |
| R-49                     | Camp Fires Permitted only at Posted Grounds.....                          | 7 x 14  |

## CAMPING

|      |  |          |
|------|--|----------|
| R-1  | No Camping Here.....                             | 7 x 14   |
| R-4  | Campground Limits .....                          | 7 x 14   |
| R-5  | Camping Permitted only at Camp Grounds (right).. | 7 x 14   |
| R-6  | Same—left arrow.....                             | 7 x 14   |
| R-7  | Public Camp Ground.....                          | 17 x 44  |
| R-20 | Camp Ground Rules .....                          | 16½ x 24 |
| O-8  | Notice to Campers Regarding Length of Stay.....  | 11 x 14  |

## CLOSED AREA AND ROADS

|      |  |         |
|------|--|---------|
| P-5  | Closed Area .....                                  | 17 x 44 |
| P-13 | Closed Road, Protection Only.....                  | 7 x 14  |
| P-16 | Closed Area .....                                  | 7 x 14  |
| P-20 | Closed Road, Protection, Land owner agreement..... | 7 x 14  |

## FIREWORKS

|      |                           |         |
|------|---------------------------|---------|
| P-11 | No Fireworks Allowed..... | 17 x 44 |
|------|---------------------------|---------|

## REGISTRATION

|      |                                 |         |
|------|---------------------------------|---------|
| P-10 | Register Here .....             | 17 x 44 |
| R-31 | Hunters, Stop and Register..... | 17 x 44 |

## SHOVEL AND AXE

|      |   |         |
|------|---|---------|
| R-27 | Shovel and Axe Per Car or Pack Train..... | 17 x 44 |
|------|---|---------|

## SMOKING

|       |  |         |
|-------|--|---------|
| S-1a  | Throwing Burning Materials From Vehicles.....    | 17 x 44 |
| S-3   | Smoking Prohibited by County Ordinance.....      | 17 x 44 |
| S-4   | Smoking Prohibited by County Ordinance.....      | 7 x 14  |
| S-5   | No Smoking Except in Camps, Etc.....             | 7 x 14  |
| S-6   | Timber Sale Area—No Smoking.....                 | 7 x 14  |
| S-11  | No Smoking Except in Camps.....                  | 17 x 44 |
| S-19  | Smoke Here—No Smoking Beyond Limits.....         | 7 x 14  |
| S-20  | No Smoking Beyond This Sign (use with S-19)..... | 7 x 14  |
| S-21  | Smoking Permitted Above this Elevation.....      | 7 x 14  |
| S-21a | Smoking Permitted Above this Elevation.....      | 17 x 44 |
| S-27  | Smoke Here, Smoke Only in Vicinity of Sign.....  | 7 x 14  |
| S-31  | Smoking Permitted Only in Area Back of Sign..... | 7 x 14  |
| 79    | Hazardous Fire Area.....                         | 7 x 14  |

## SUPPRESSION

|      |                           |         |
|------|---------------------------|---------|
| P-15 | Fire Camp.....miles ..... | 7 x 14  |
| P-23 | Spot Fire .....           | 5 x 7   |
| L-3  | Forest Fire Fighters..... | 11 x 14 |



## PREVENTION

|      |                             |         |
|------|-----------------------------|---------|
| F-1  | Help Prevent Fires.....     | 7 x 14  |
| F-1a | Help Prevent Fires.....     | 17 x 44 |
| L-2  | Reward .....                | 11 x 14 |
| O-10 | Good Manners In Forest..... | 11 x 14 |

## REGION 5 FIRE FORMS

### CAMP FIRE PERMITS

|          |                                     |                              |
|----------|-------------------------------------|------------------------------|
| 874 (36) | Camp Fire Permits.....              | Notebook size<br>Pads of 100 |
| 14       | Camp Fire Permit Register.....      | 9 x 22                       |
| 15       | Field Record Camp Fire Permits..... | Notebook size                |

### CAMPERS

|    |                                      |               |
|----|--------------------------------------|---------------|
| 28 | Report on Campers and Sportsmen..... | Notebook size |
| 47 | Patrolman's Report on Campers.....   | Notebook size |

### REGISTRATION

|    |                                  |            |
|----|----------------------------------|------------|
| 44 | Hunters' Register .....          | 5 x 8 Card |
|    | Hunters' Windshield sticker..... |            |

Supervisor's requisition, in duplicate, on Form 668, from Supply Depot by December 31.

## APPENDIX 11

### FIRE CAMP LAYOUT

#### NUMBER OF MEN PER CAMP

Exclusive of camp operation, 500 men should be the maximum number, including both shifts, in any one camp. Where more men are used on a single fire, establish other camps to care for them.

#### CAMP LOCATION

Camps should be convenient to the control lines.

#### FIRE CAMP LAYOUTS

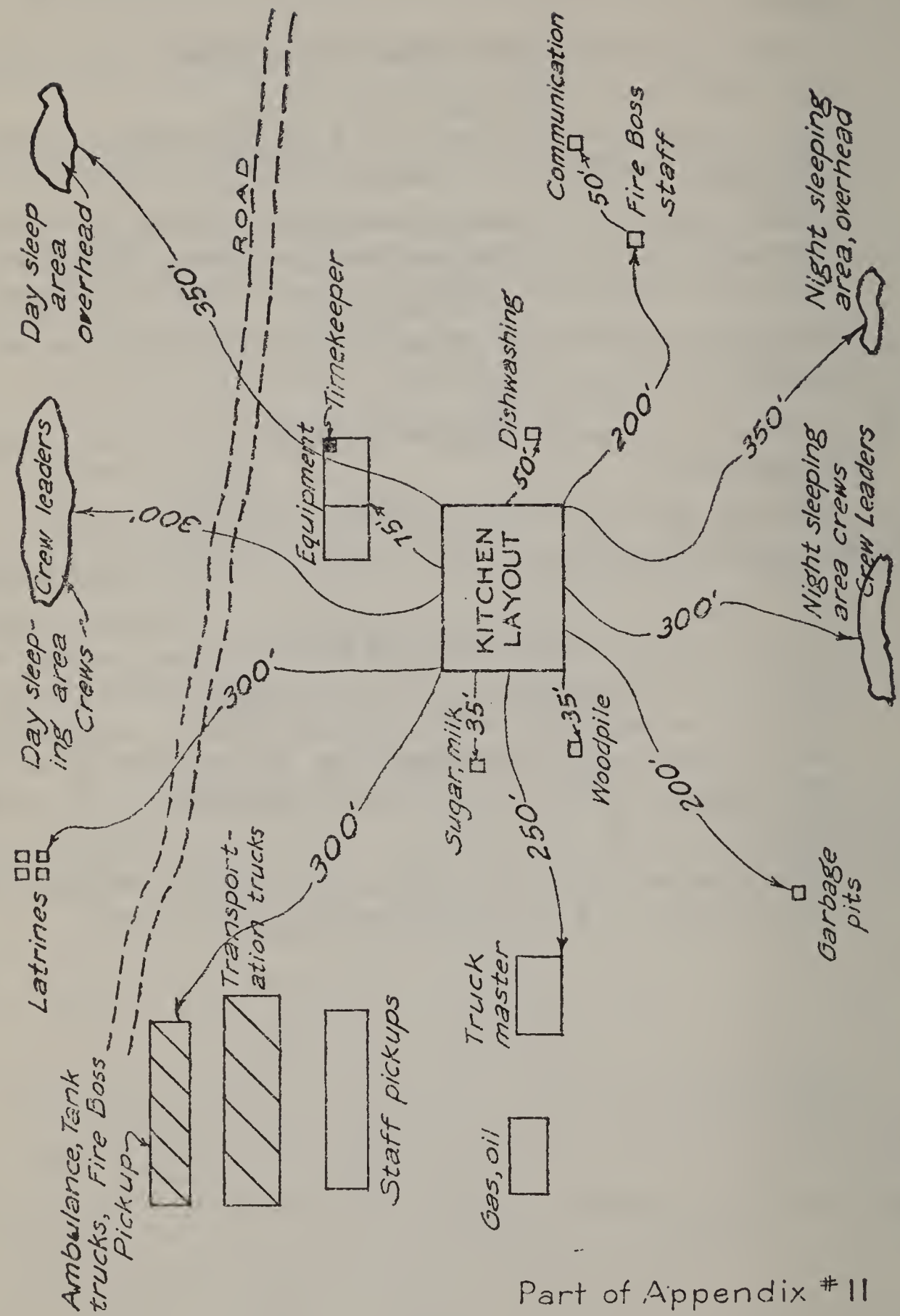
The following are essential to smooth operation of any fire camp:

1. The layout should be as compact as possible so that the camp boss may see at a glance what is taking place.
2. Guard ropes should be provided to preserve alignment of crews when feeding and checking in or out, and to define camp limits.
3. Large wood piles should be kept out of the enclosure.
4. Cafeteria style arrangement should be used and provision made to feed two lines simultaneously. Men should not be permitted to eat at the serving tables.

5. Sugar, butter and cream should be placed 35 feet from the exit from the serving tables, with a man in charge.
6. Garbage holes should be well away from camp. A garbage box should be provided near where the crews will eat, and also a box for dirty dishes.
7. Latrine pits should be well away from the main camp, kitchen and water supplies.
8. Dish washing should be kept away from the enclosure, except when small crews are used and it does not interfere with the cook.
9. Definite places for obtaining drinking and cooking water, for watering stock and for washing should be designated. The place for obtaining drinking water should be protected against pollution.
10. Instruct the cook how to operate the layout and feed the men.
11. Adapt layout to the ground.
12. All entrances through the guide ropes, except the ones in use, should be blocked off.
13. With this layout ten men can be fed per minute.
14. Consult the camp ground layout diagram before setting up camp.
15. The shape of the layout is immaterial; rectangular, round, "V" shape, or having the tables in one line may prove the best arrangement for the particular site. Any arrangement which provides facilities for rousing night crews, checking them in and feeding them, and checking them out of camp in less than one hour is satisfactory. This standard should be maintained, regardless of the size of the crew.
16. Sleeping areas for day and night crews should be established in separate locations well away from the noise of the camp.



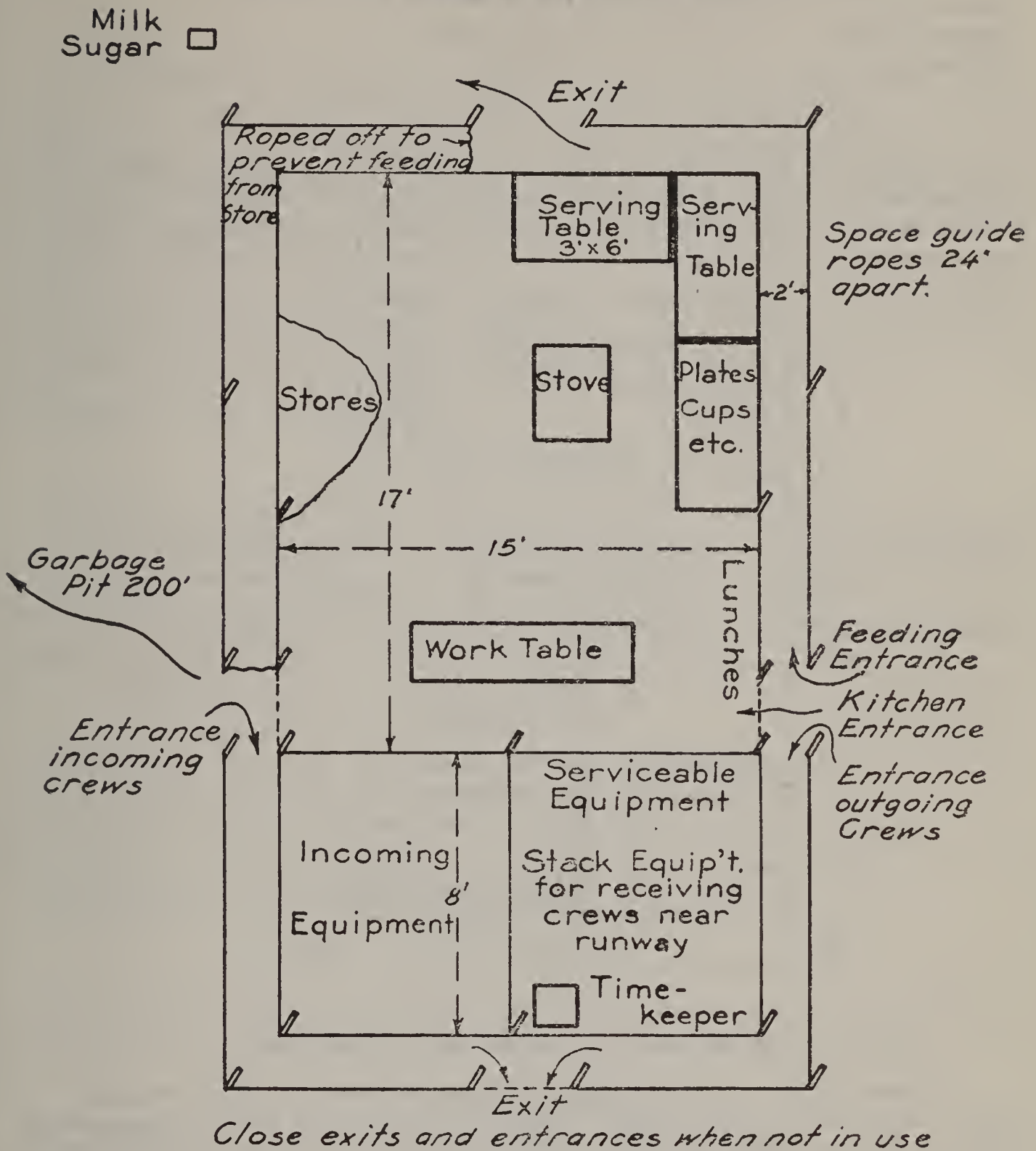
# DIAGRAMMATIC SKETCH OF CAMP LAYOUT FOR LARGE CREWS (DISTANCES INDICATED ARE DESIRABLE MINIMUM)



Part of Appendix # 11

# FOREST FIRE CAMP LAYOUT

## 60-100 MEN PER SHIFT

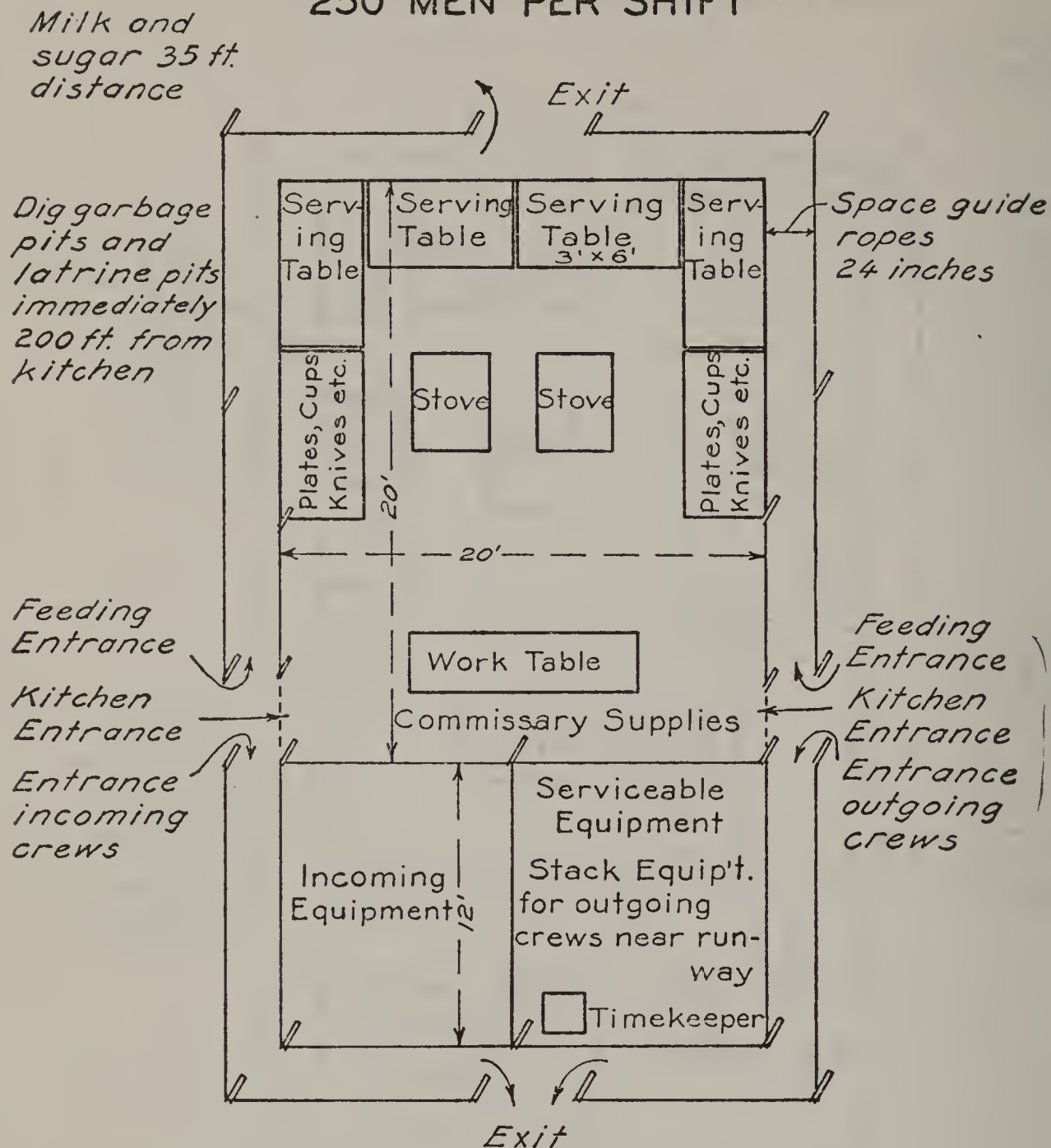


*Note that the only difference between this camp and the 250 men layout is the number of stoves, size of layout, number of receiving tables and size of tool and equipment space. This camp will handle 60 to 100 men per shift.*



# FOREST FIRE CAMP LAYOUT

## 250 MEN PER SHIFT



*Close exits and entrances when not in use.*

*Place butter, milk, sugar, coffee, bread, jam, salt and pepper 35 ft. away from the feeding exits to avoid bunching of men when feeding from both sides. 400 ft. of rope will line out the camp and provide a surplus with which to expand the layout if necessary. This size layout will handle 250 men per shift without crowding, and the minimum feeding rate should be 10 men per minute. Place power grinder and tool repair set-up some distance away from this layout if telephone or radio is installed here in order to eliminate noise.*

Part of Appendix # II

# APPENDIX 12

## FORMS FOR USE ON LARGE FIRES

### FC—FORM 1

*Fire Organization.* This form is to be used to show the Fire Organization by divisions and sectors. Forms are to be made up for each shift. Sketch map on the reverse side of the form to be made up before issuing, showing the Forest Officer concerned, the location of his assignment, and its relation to adjacent units. The necessary information to be obtained from the written instructions of the Fire Boss. Copies to be furnished Fire or Zone Boss and staff, Camp, Division and Sector Bosses. Line officers will fill in accomplishment section and submit to their superior officer at end of shift. The organization of the entire fire is shown by grouping one copy of each division chart.

### FC—FORM 2

*Cumulative Report.* The form is to be used as a master, division, sector or camp record. A separate form will be made up as a cumulative record for overhead, labor, equipment and transportation. It will furnish the Fire or Zone Boss the basic data used in working up the control plans and fire organization charts.

### FC—FORM 3

*Man-Power Record.* This form shows the number of men and overhead available, and also the number dispatched to a fire. It will be used in the Fire Headquarters or Fire Camp to make information available to the Fire Boss. A current exchange of information between the Fire Camp and Dispatcher is necessary to keep the form posted.

### FC—FORM 4

*Transportation Record.* This form is to be used by the Truck Master in each fire camp to maintain a record of transportation.

### FC—FORM 5

*Crew Boss Time Report.* This form is to be filled in by the Crew Leader as a time record of his crew personnel. This form to be made in duplicate, one copy to be turned in to timekeeper when leaving for fire line, and one copy to be turned in upon return to camp.

### FC—FORM 6

*Crew Leader Tool Record.* The Crew Leader is accountable for all tools, equipment and bedding issued to his crew. Prior to leaving camp he will fill out and sign this form in duplicate, giving original copy to Sector Boss, who will turn it over to the Tool Tender. When tools are obtained,



Crew Leader will check tools against list. Upon return of tools to Tool Tender, list on carbon copy the number returned for him to check. Any shortages will be explained in writing under "Remarks."

This form will also be used for an exchange of tools between Crew Leaders on the fire line, copy of such transfer being given the Tool Tender.

This form will also be used for issuance of blankets or bedding.

#### FC—FORM 7

*Temporary Fire Property Record.* This form will be used to cover property transferred between fire camps, and between fire camps and warehouse.

#### FC—FORM 8

*Progress Map Symbols.* Progress maps (scale 4 inches equal to 1 mile) will be posted by 7 A.M. and 7 P.M. each day, using the symbols shown on the standard fire map Form FC—8.

FIRE ORGANIZATION  
FIRE, ZONE, DIVISION OR SECTOR.

|                              |                          |                               |
|------------------------------|--------------------------|-------------------------------|
| NAME OF FIRE _____           | DATE _____               | ON SHIFT (DAY OR NIGHT) _____ |
| FIRE BOSS OR ZONE BOSS _____ | CAMP BOSS _____          |                               |
| STAFF:                       | CAMP BOSS STAFF:         |                               |
| ASST. FIRE BOSS _____        | ASST. CAMP BOSS _____    |                               |
| CHIEF OF STAFF _____         | TIMEKEEPER _____         |                               |
| TRANSPORTATION CHIEF _____   | SUPPLY OFFICER _____     |                               |
| COMMUNICATION CHIEF _____    | TOOL TENDER _____        |                               |
| SUPPLY CHIEF _____           | TRUCK MASTER _____       |                               |
| LINE INSPECTORS _____        | COMMUNICATION MAN _____  |                               |
|                              | MESS OFFICER _____       |                               |
|                              | MAP & RECORD CLERK _____ |                               |
| SCOUTS _____                 | FIRST AID _____          |                               |

|                                  |                     |               |
|----------------------------------|---------------------|---------------|
| DIVISION _____                   | DIVISION BOSS _____ | NO. MEN _____ |
| DIVISION WORK INSTRUCTIONS _____ |                     |               |
| _____                            |                     |               |
| _____                            |                     |               |
| _____                            |                     |               |

|              |                   |               |          |
|--------------|-------------------|---------------|----------|
| SECTOR _____ | SECTOR BOSS _____ | NO. MEN _____ | MEN SENT |
|              | CREW BOSSES _____ | _____         | _____    |
|              | _____             | _____         | _____    |
|              | _____             | _____         | _____    |
|              | _____             | _____         | _____    |

|              |                   |               |          |
|--------------|-------------------|---------------|----------|
| SECTOR _____ | SECTOR BOSS _____ | NO. MEN _____ | MEN SENT |
|              | CREW BOSSES _____ | _____         | _____    |
|              | _____             | _____         | _____    |
|              | _____             | _____         | _____    |
|              | _____             | _____         | _____    |

|              |                   |               |          |
|--------------|-------------------|---------------|----------|
| SECTOR _____ | SECTOR BOSS _____ | NO. MEN _____ | MEN SENT |
|              | CREW BOSSES _____ | _____         | _____    |
|              | _____             | _____         | _____    |
|              | _____             | _____         | _____    |
|              | _____             | _____         | _____    |

|              |                   |               |          |
|--------------|-------------------|---------------|----------|
| SECTOR _____ | SECTOR BOSS _____ | NO. MEN _____ | MEN SENT |
|              | CREW BOSSES _____ | _____         | _____    |
|              | _____             | _____         | _____    |
|              | _____             | _____         | _____    |
|              | _____             | _____         | _____    |

SECTOR WORK INSTRUCTIONS: (INCLUDE ROUTES, TRAVEL, WORK TO BE DONE, ETC.)

|              |       |
|--------------|-------|
| SECTOR _____ | _____ |
|              | _____ |
|              | _____ |
| SECTOR _____ | _____ |
|              | _____ |
|              | _____ |
| SECTOR _____ | _____ |
|              | _____ |
|              | _____ |
| SECTOR _____ | _____ |
|              | _____ |
|              | _____ |



ACCOMPLISHMENTS

|                     | ASSIGNED (CH.)            |                        | COMPLETED(CH.)            |                        | BAL. NEXT SHIFT (CH.)     |                        |
|---------------------|---------------------------|------------------------|---------------------------|------------------------|---------------------------|------------------------|
|                     | LINE FOR<br>DIRECT ATTACK | LINE FOR<br>BACKFIRING | LINE FOR<br>DIRECT ATTACK | LINE FOR<br>BACKFIRING | LINE FOR<br>DIRECT ATTACK | LINE FOR<br>BACKFIRING |
| SECTOR              |                           |                        |                           |                        |                           |                        |
| SECTOR              |                           |                        |                           |                        |                           |                        |
| SECTOR              |                           |                        |                           |                        |                           |                        |
| SECTOR              |                           |                        |                           |                        |                           |                        |
| DIVISION<br>(TOTAL) |                           |                        |                           |                        |                           |                        |

IN CASE OF MOP UP CREWS INDICATE ON MAP AREA COVERED.

MAP

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
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FC 2

## CUMULATIVE REPORT

NAME OF FIRE

DATE \_\_\_\_\_

MASTER } (OVERHEAD  
DIVISION } RECORD OF (LABOR  
SECTOR } (EQUIPMENT  
CAMP } (TRANSPORATION

SIGNATURE

(CROSS ALL BUT ONE OF EACH LIST)

LOCATION

[illegible]





FC 5

## CREW BOSS TIME REPORT

\_\_\_\_\_  
NAME OF FIRE

\_\_\_\_\_  
NAME OF CREW BOSS

\_\_\_\_\_  
DATE

\_\_\_\_\_  
ON SHIFT

\_\_\_\_\_  
OFF SHIFT

ASSIGNMENT: DIV. \_\_\_\_\_ SECT. \_\_\_\_\_ OTHER \_\_\_\_\_

LIST CREW PERSONNEL BELOW BY NAME AND OTHER MEANS OF IDENTIFICATION:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_
11. \_\_\_\_\_
12. \_\_\_\_\_
13. \_\_\_\_\_
14. \_\_\_\_\_
15. \_\_\_\_\_
16. \_\_\_\_\_
17. \_\_\_\_\_
18. \_\_\_\_\_
19. \_\_\_\_\_
20. \_\_\_\_\_

REMARKS:



FC 6

# CREW BOSS TOOL RECORD

DATE \_\_\_\_\_

NAME OF FIRE

CREW BOSS

[illegible]

# TEMPORARY FIRE PROPERTY TRANSFER RECORD

\_\_\_\_\_ NATIONAL FOREST

\_\_\_\_\_ 193

NAME OF FIRE \_\_\_\_\_ DATE \_\_\_\_\_

FROM \_\_\_\_\_ ORDERED BY: \_\_\_\_\_

TO: \_\_\_\_\_

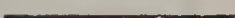


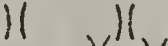





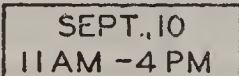
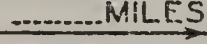

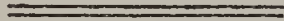

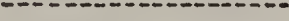



| NO. | ARTICLE                        | NO. | ARTICLE                           |
|-----|--------------------------------|-----|-----------------------------------|
|     | AXES (LIST KIND)               |     | PUMPS, POWER                      |
|     | BADGE, CREW BOSS               |     | RADIOS, PORTABLE, COMPLETE        |
|     | BAGS, SLEEPING                 |     | RAKES                             |
|     | BATTERIES, FLASHLIGHT          |     | ROPE                              |
|     | BATTERIES, RADIO               |     | SAWS, FALLING                     |
|     | BINDER, RING, 874C             |     | SAWS, HAND                        |
|     | BLANKETS, BED                  |     | SHEATHS, BRUSH KNIFE              |
|     | BOX, CAMP BOSS (COMPLETE)      |     | SHOVELS, LHRP                     |
|     | CANS, MILK, WATER              |     | STOVES, (LIST KIND)               |
|     | CANTEENS 1GAL.                 |     | TABLES, FOLDING                   |
|     | CHAIRS, CAMP FOLDING           |     | TELEPHONES, PORTABLE (LIST MODEL) |
|     | FILES                          |     | TOOLS, MC LEOD                    |
|     | FLAME THROWERS                 |     | TOOLS, PULASKI                    |
|     | FLASHLIGHTS, HAND              |     | TORCH, HAUCK                      |
|     | FLIES, TENT (LIST SIZES)       |     | TORCH, ORCHARD                    |
|     | FORKS, PITCH, ASSORT.          |     | WEDGES, AXE                       |
|     | DIES, F.S.                     |     | WEDGES, FALLING                   |
|     | GASOLINE, (GALS.)              |     | WIRE, EMERGENCY, (FT)             |
|     | GENERATORS, COLEMAN            |     |                                   |
|     | GRINDERS, TOOL, POWER, PORT.   |     |                                   |
|     | GRINDERS, TOOL, HAND           |     |                                   |
|     | HAMMER, CLAW                   |     |                                   |
|     | HAMMER, SLEDGE                 |     |                                   |
|     | HOSE, FIRE (LIST SIZES)        |     |                                   |
|     | HOES                           |     |                                   |
|     | HOOKS, BRUSH                   |     |                                   |
|     | IRON, BRANDING U.S.F.S.        |     |                                   |
|     | KEROSENE, (GALS.)              |     |                                   |
|     | KNAPSACKS                      |     |                                   |
|     | KNIVES, BRUSH                  |     |                                   |
|     | KITS, FIRST AID, - LARGE       |     |                                   |
|     | LAMPS, ELECTRIC HEADLIGHT      |     |                                   |
|     | LANTERNS, GASOLINE             |     |                                   |
|     | LOCKS, PAD, F.S.               |     |                                   |
|     | LOCKS, PAD, NOT F.S.           |     |                                   |
|     | MANTLES, COLEMAN               |     |                                   |
|     | MATTOCKS                       |     |                                   |
|     | MATTRESSES (OR PADS) FOR COTS  |     |                                   |
|     | OUTFITS, BACK PACK (LIST KIND) |     |                                   |
|     | OUTFITS, MESS (LIST KIND)      |     |                                   |
|     | OUTFITS, SNAKE BITE            |     |                                   |
|     | PSYCHROMETER, SLING            |     |                                   |

\_\_\_\_\_ TRUCK DRIVER OR RECEIVING OFFICER

(FILL OUT IN DUPLICATE. TO BE USED FOR TRANSFER FROM WAREHOUSE TO FIRE OR FROM ONE CAMP TO ANOTHER. RETAIN ORIGINAL AND ROUTE DUPLICATE BY DRIVER TO BE DELIVERED TO CAMP BOSS OR MAN IN CHARGE OF FIRE. USE SAME FORM FOR RETURN OF EQUIPMENT.)



## SYMBOLS FOR MAPPING

|   |   |   |
|---|---|---|
| UNCONTROLLED LINE   |    | SOLID RED LINE  |
| CORRALLED   |    | BROKEN BLACK LINE   |
| CONTROLLED  |    | SOLID BLACK LINE  |
| CULTURE - STANDARD FOREST SERVICE SYMBOLS - (SEE MANUAL)<br>(SHOW MAIN TOPOGRAPHICAL FEATURES BY CONTOUR OR HATCHER.) |   |   |
| SECTORS - NUMBERS   |   | ROUND BRACKETING, SMALL   |
| DIVISIONS - LETTERS   |   | SQUARE BRACKETING, LARGE  |
| FIRE CAMP   |    | RED   |
| FIRE HEADQUARTERS   |    | RED   |
| COMMUNICATION STATION   |   | BLACK WITH T FOR TELEPHONE,<br>R FOR RADIO, ETC.  |
| BURNS BY PERIODS  |    | USE DIFFERENT COLOR FOR EACH<br>PERIOD & COLOR IN SOLID EXCEPT<br>FOR IDENTIFICATION OF PERIOD BLOCK. |
| WIND DIRECTION & VELOCITY   |    | ARROW INDICATES DIRECTION, WITH<br>MILES IN NUMERALS ON STEM OF ARROW                                 |
| TELEPHONE   |    |   |
| ROADS - GOOD  |    |   |
| POOR  |    | PENCIL  |
| TRAILS  |    | PENCIL  |
| FIREBREAKS  |    | BLACK   |
| SPOT FIRES  |    | SOLID RED CIRCLE  |
| SECONDARY LINE OF DEFENSE   |    | ORANGE LINE   |
| NAME - DATE - SEC. TOWNSHIP - RANGE - SCALE   |   |   |

# APPENDIX 13

## FIRE GUARD EXAMINATION

### FOREWORD

The following examination, used on Los Padres Forest, is useful as an example. The detailed questions in the oral and field tests would naturally be adapted to needs of individual Forests.

### THE EXAMINING BOARD

The examining board will consist of District Ranger, Forest Supervisor, Assistant Supervisor, Fire Control Assistant, and Fire Dispatcher.

All applicants, regardless of position applied for, will be given the same examination, but lookouts will take the eye test in lieu of field tests.

The men taking the written examination will be instructed that when they hand in their last paper and the examiner tells them "that is all" they will leave the room and wait at a designated place until their name is called to take the oral test.

Similar instructions will be given the examinees by the oral examiner relative to their standing-by until called for the field test.

### RATING

The relative weights of the two units in the examination are as follows:

1. Written examination.....40%
2. Oral and Field examination.....60%

### Instructions for Rating:

The following weights will be used in grading the papers in the written examinations and in rating the applicants in their oral and field tests:

#### I. *Written Examination*

- a. Mental Alertness, Part I  
Test 1, 2 and 3—55 questions  
 $\frac{1}{4}$  per cent each and  $\frac{1}{2}$  for writing = 14%
- b. Ability to read maps, Part II  
10 questions, 1 per cent each = 10%
- c. Knowledge of job, Part III  
8 questions at 2 per cent each = 16%

#### II. *Oral Test*

The members of the board will grade the applicant on a combination of personality, ability to meet the public, bearing and neatness.



Use the following scale for grading:

9 — 10% — Excellent

5 — 6% — Fair

7 — 8% — Good

Below — Failed

### III. *Field Test*

In grading the applicants on their use in handling stock, care should be used in judging the applicant's lack of recent experience, if this is the case, or if inexperienced, he should be judged in ability to acquire this knowledge.

Use the following scale for grading use of *saddle stock* and *tools*:

15% — Excellent

12% — Good

9% — Fair

Use the following scale in grading use of *pack stock*:

20% — Excellent

15% — Good

10% — Fair

### Mental Test

Each applicant will be rated according to the correctness of his written answers and upon the amount of time taken to complete this part of the examination.

### Oral Test

A member of the board will be designated as Examiner, and will read to the board excerpts from the application relative to his age, matrimonial status, education, experience, etc., prior to the entrance of the applicant. He will then be questioned as to:

1. The kind of work he has done the past year.
2. The kind of work he likes best, and is best qualified for.
3. His experience in meeting the public.
4. His experience in handling pack and saddle stock.
5. What experience he has had in fire fighting, staying alone, cooking, etc.
6. Why he desires to work for the Forest Service (*i. e.*, try to work into a steady job or to make a stake to help him obtain some other position).
7. He will also be asked one or two questions relative to fire problems as the examiner or any member of the board see fit.

The examiner may request other members of the board to question the applicant. Each member of the board will rate the applicant on everything except mental alertness on the regular rating sheet.

## Field Test

Applicants will be sent individually to a designated place where a saddle, blanket, bridle and rope are piled. He will be instructed to catch, saddle and mount the horse in the adjoining corral. At another designated place a complete pack outfit and  $3\frac{3}{4}$  sacks of barley will be piled up near where a pack mule is tied. The applicant will be instructed to pack up the mule with the load at hand.

In both of the above field tests the applicant will be judged on his demonstrated ability to handle stock or in his ease and aptitude to acquire such ability.

The examiner will explain our method of constructing a fire line in brush cover. The applicant will then be told to cut a short piece of fire line, using a brush hook, axe and shovel. He will be rated on his ability to use tools and either knowledge of the job or ability to grasp instructions.

If the brush cover does not bring out the use of an axe the examiner will send the applicant to a log, instructing him to cut off a 2-foot length. He will be rated on knowledge or ability to grasp instructions if he shows lack of knowledge of its proper use.

All field tests will be so arranged that applicant will not be allowed to see the work of others before his test is made. For instance, the two tests in the use of stock could be placed one on each side of the barn, etc.

## Applicants

Each District Ranger will extend invitation to the number of applicants it will take to fill the vacancies on his district based on the number of men hired last year. Therefore, District Rangers who have more applications than vacancies should choose the outstanding applicants, and any of those who have a shortage of applicants can communicate with other District Rangers or the Supervisor's office.



TIME  
 Start..... Name.....  
 Finish..... Address.....  
 Taken.....

## FOREST GUARD EXAMINATION

U. S. Forest Service

Los Padres National Forest

### PART I

### MENTAL ALERTNESS TESTS

#### TEST 1

This is a test of common sense. Below are 15 questions. Three answers are given to each question. You are to look at the answers carefully, then make a cross on the line before the best answer to each question, as in the sample :

Why do we use stoves? Because  
 ..... they look well  
 .... x .... they keep us warm  
 ..... they are black

- |   |   |
|---|---|
| 1. Cats are useful animals, be-<br>cause<br>..... they catch mice<br>..... they are gentle<br>..... they are afraid of dogs   | ..... it makes a good appear-<br>ance<br>..... it is strong and lasting<br>..... it is heavy  |
| 2. Shoes are made of leather, be-<br>cause<br>..... it is tanned<br>..... it is tough, pliable and<br>warm<br>..... it can be blackened                                     | 5. National Forests belong to:<br>..... the President of the U. S.<br>..... the people of the U. S.<br>..... the Dept. of Agriculture   |
| 3. If it rains when you are start-<br>ing to go for the doctor, what<br>should you do?<br>..... stay at home<br>..... take an umbrella<br>..... wait until it stops raining | 6. Why are criminals locked up?<br>..... to protect society<br>..... to get even with them<br>..... to make them work   |
| 4. The main reason why stone is<br>used for building purposes is<br>because   | 7. Burning matches and tobacco<br>must not be thrown from ve-<br>hicles because<br>..... they litter the roadway<br>..... there is a State Law<br>against it<br>..... they might start a forest<br>fire |

8. Why should a married man have his life insured? Because  
..... death may come at any time  
..... insurance companies are honest  
..... his family will be provided for when he dies
9. A camper is required to carry a shovel and axe because  
..... it will aid him in putting out his camp fire or any other fire that might start near him  
..... The Forest Service cannot afford to furnish these tools  
..... they are needed should the camper's car get stuck
10. Water boils more quickly on a mountain top than in the valley because  
..... the pressure of the atmosphere is less  
..... mountain water is purer  
..... vapor condenses more rapidly on the mountain top
11. If a man who can't swim should fall into a river, he should  
..... yell for help and try to scramble out  
..... dive to the bottom and crawl out  
..... lie on his back and float
12. Livestock is grazed in National Forests because  
..... the climate is cooler  
..... the forage makes better beef  
..... it is desired to utilize forage crops as fully as the protection of the forest will permit
13. All traffic going one way keeps to the same side of the road because  
..... most people are right-handed  
..... the traffic policemen insist on it  
..... it avoids confusion and collisions
14. Forests regulate stream flow by  
..... absorption of rain by the ground litter  
..... the snow that falls on the mountain slopes  
..... dams built across streams
15. How much of a load would you put on an average pack mule and travel fifteen miles on an average mountain trail?  
..... 75-pound load  
..... 150-pound load  
..... 350-pound load



Start.....Name.....

Finish.....Address.....

Taken.....

PART I

TEST 2

If the two words of a pair mean the same or nearly the same, draw a line under the word "same." If they mean the opposite, or nearly the opposite, draw a line under the word "opposite." The two samples are already marked as they should be.

SAMPLES {good—bad .....same—opposite  
          {little—small .....same—opposite

1. No—yes .....same—opposite
2. day—night .....same—opposite
3. go—leave .....same—opposite
4. begin—commence .....same—opposite
5. bitter—sweet .....same—opposite
6. assume—suppose .....same—opposite
7. command—obey .....same—opposite
8. tease—plague .....same—opposite
9. diligent—industrious .....same—opposite
10. corrupt—honest .....same—opposite
11. masculine—feminine .....same—opposite
12. complex—simple .....same—opposite
13. often—seldom .....same—opposite
14. ancient—modern .....same—opposite
15. acquire—lose .....same—opposite
16. sterile—fertile .....same—opposite
17. somber—gloomy .....same—opposite
18. credit—debit .....same—opposite
19. transient—permanent .....same—opposite
20. pertinent—relevant .....same—opposite

TIME

|             |              |
|-------------|--------------|
| TIME        |              |
| Start.....  | Name.....    |
| Finish..... | Address..... |
| Taken.....  | .....        |

PART I

TEST 3

In each of the sentences below you have four choices for the last word. Only one is correct. In each sentence draw a line under one of these four words which makes the truest sentence. The two samples are already marked as they should be.

SAMPLES { People hear with the eyes, ears, nose, mouth.  
 France is in Europe, Asia, Africa, Australia.

- The apple grows on a shrub, vine, bush, tree.
- Five hundred is played with rackets, pins, cards, dice.
- The Percheron is a kind of goat, horse, cow, sheep.
- Timothy is a kind of corn, rye, wheat, hay.
- Coral is obtained from mines, elephants, oysters, reefs.
- The rutabaga is a lizard, vegetable, fish, snake.
- Chard is a fish, lizard, vegetable, snake.
- The penguin is a bird, fish, reptile, insect.
- Ivory is obtained from elephants, mines, oysters, reefs.
- Maize is a kind of corn, hay, oats, rice.
- Cypress is a kind of machine, food, tree, fabric.
- An aspen is a machine, fabric, tree, drink.
- The sabre is a kind of musket, sword, cannon, pistol.
- The mimeograph is a kind of typewriter, copying machine, phonograph, pencil.
- Maroon is a food, fabric, drink, color.
- The clarionet is used in music, stenography, bookbinding, lithography.
- Denim is a dance, food, fabric, drink.
- Cerise is a color, drink, fabric, food.
- Arson is a term used in medicine, law, theology, pedagogy.
- Turpentine comes from petroleum, hides, trees, insects.



TIME

Start.....  
Finish.....  
Taken.....

Name.....  
Address.....  
.....

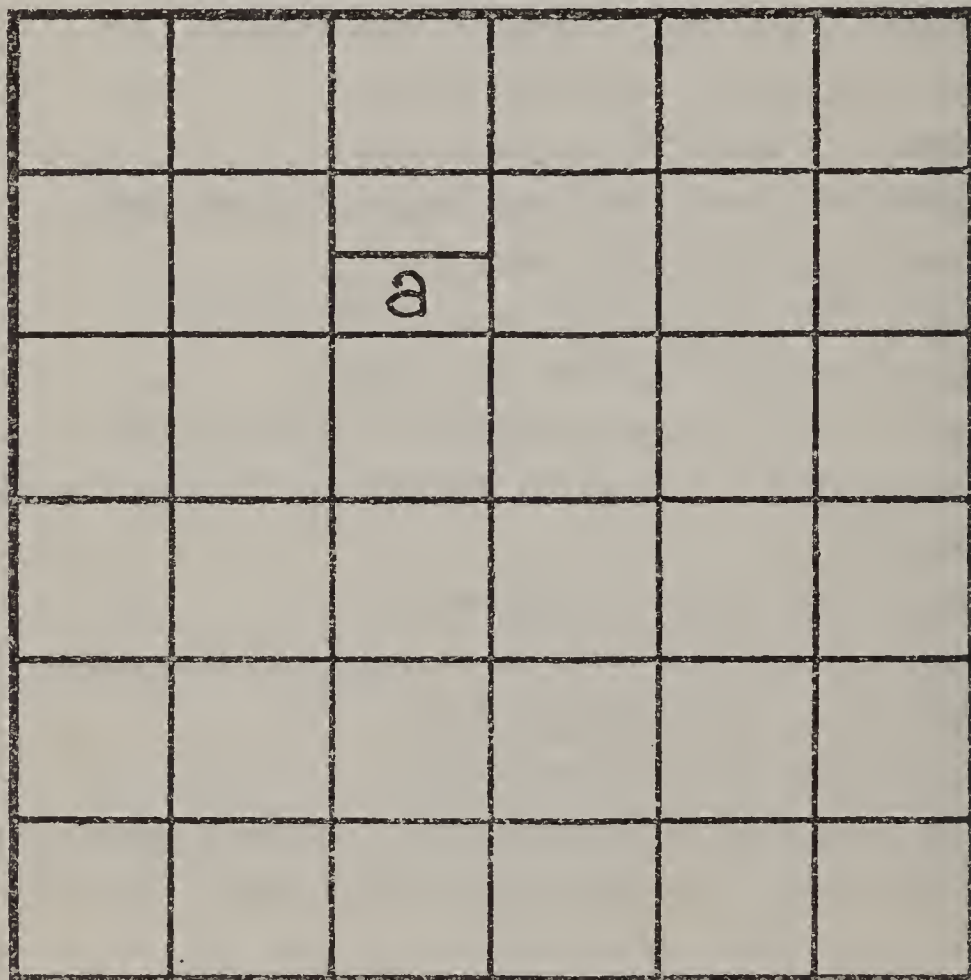
PART II  
MAP READING  
TEST 1

The following is quoted from the General Land Office Survey Manual describing the method of numbering the sections in a township: "The sections shall be numbered consecutively, beginning with the number one in the *northeast* section and proceeding west and east alternately, through the township, with progressive numbers till the thirty-six be completed."

PROBLEMS

1. Number the sections in the township plat below.
2. What is the area in acres of the unit marked (a) below .....
3. Give the legal description of the unit marked (a) below .....
4. Place an X indicating the southwest corner of Section 21.
5. Indicate with a pencil the boundary of the NE  $\frac{1}{4}$  of the SW  $\frac{1}{4}$  of Sec. 29.

Scale:  $\frac{1}{2}$  inch = 1 mile



The following questions are of the completion type. Merely fill in the blank with what you believe to be the correct answer.

1. One side of section is ..... feet in length.

2. There are ..... feet in a chain and ..... chains in a mile.
3. The perimeter of the unit (a) above is ..... miles.
4. A standard township is ..... square miles.

#### TIME

Start..... Name.....  
 Finish..... Address.....  
 Taken.....

### PART III KNOWLEDGE OF JOB

#### TEST 1

1. Assume you are a Forest guard at your headquarters. A Forest visitor asks you a question on a subject upon which you have not received instructions. What answer would you give?
2. Assume that while on patrol you contact a hunter that has just shot a buck in a steep, rough, rocky, brushy canyon. He is struggling along through the brush, packing the deer, when you meet him. He has not attached his deer tag to the horns of the buck, as required by the State game law. He tells you he has not put the tag on because it would be sure to be torn off going through the brush, and intended to attach it when he got on top of the ridge, out of the heavy brush. Would you arrest this man? If so, why. If not, why?
3. If you had six hundred pounds of supplies to pack by mule fifteen miles over the average mountain trail, how many mules and how long will it take to do the job in one trip?
4. Normally, how long does it take to hike eight miles over the average mountain trail?
5. While hiking along a trail some distance from a place of habitation you come upon a man who has just been bitten by a rattlesnake. What action would you take to help this man?
6. What is an average pack weight for a man of average size to carry in the mountains for a distance of five miles?
7. Make up an order for food supplies for one week, keeping in mind that you will be located twenty-five miles back in the mountains away from any source of supplies.
8. What type of horse is best suited for patrol work in the mountains? Should he be shod for this type of work?



# APPLICATION FOR EXAMINATION TEMPORARY FOREST PROTECTION WORK

U. S. FOREST SERVICE

CALIFORNIA REGION

Age limits for Lookout position 21 to 55 years. Applicant must answer questions in own handwriting.

1. Position for which application is made—Lookout    Patrolman    Fireman  
(Check which)
2. Name in full.....
3. Legal residence.....  
(Street)                      (Post Office)                      (State)  
.....  
(Telephone number)
4. Where born .....  
(State or Foreign Country)                      (City or County)
5. If foreign, state whether naturalized or alien.....
6. Date of birth.....  
(Year)              (Month)              (Day)              (Age last birthday)
7. Are you single, married, divorced, widowed?.....
8. If married, number of dependents..... Age of children.....
9. Notify in case of serious sickness, accident or death.....  
.....
10. If married will you accept position without family accompanying you?  
(Name)                      (Relationship)                      (Address)  
.....
11. Form and amount of insurance carried.....  
Company .....
12. Education: Grammar school.....years.  
High school.....years.  
College.....years.                      (Name of College)  
Special course pursued at college.....
13. State general condition of your health and physical defects, if any.  
.....
14. Are you physically able to perform hard manual labor?.....
15. Exact weight..... Height.....
16. Do you wear glasses.....; if so, state nature of eye trouble  
.....
17. Hearing: If defective, to what extent.....
18. Speech: If defective, describe it.....
19. Condition of heart.....
20. Any stomach trouble.....

21. Have you hernia (rupture).....
22. Knowledge of country in which you seek employment.....
23. Have you ever been employed in any Forestry or Forest Fire Protection organization?..... If so, where located, period of service, and nature of work.....
24. Lumbering operation, period of service, and nature of work.....
25. Ranching, or handling livestock on the range, experience.....
26. State in detail extent of experience in the actual suppression of Forest Fires .....
27. State experience as Foreman.....
28. In what trades or occupation are you experienced?.....
29. Can you furnish light car?.....Saddle horse?.....  
(If required forage will be furnished; 5c mileage will be allowed for official use of cars.)
30. Are you willing to accept work anywhere in California?.....
31. Will you accept the Forest Service minimum wage scale of.....  
per month?
32. If employed, when could you report for duty?.....
33. Did you fill out this application yourself?.....

.....  
(Date)

.....  
(Signature of Applicant)

Names and addresses of three references, two of which should be former employees.

| NAME | ADDRESS |
|------|---------|
|------|---------|

|       |       |
|-------|-------|
| ..... | ..... |
| ..... | ..... |
| ..... | ..... |



## APPENDIX 14

### PREPARATION OF INDIVIDUAL FIRE REPORTS IN "MIXED ACTION" CASES

Two principles will aid in filling out steps (2) to (16) on Forms 929. These are:

1. The action of cooperators is just as important as that of Forest Service personnel. We usually know more about Forest personnel action than about the action of outsiders, but the time elements, distances, etc., involved in cooperators' actions should be estimated, because their actions often result in the corral of small fires before the Forest personnel has arrived.

2. Effective action should be recorded in chronological order on the form. In cases where both outsiders and the Forest Service take action, the general rule is to record *first* action.

The following procedure should be adhered to as closely as possible in fire report preparation. The numbers refer to the numbered lines on Forms 929:

2. Record the earliest discovery.
3. Record the next discovery.
4. Record the earliest time at which a person responsible for control action was informed of the fire. If man discovering fire took action to suppress it leave the line blank.
5. Record the first person who is dispatched to the fire. If the person to whom fire is first reported (Line 4) goes himself, insert dash in line 5.
6. Record the action of the first man to leave for the fire. If an outsider who discovers the fire goes to it, record the outsider's action and his getaway time computed from the time he discovers the fire to the time he leaves for it. Insert dash if person finds fire and starts work thereon without travel.
7. Is intended to describe the action of the person designated in line (6). If the first person to leave for the fire is not the first one to arrive at it, the name of the first person to arrive should be written in over "Arrived at Fire" and his arrival time recorded. In such cases the travel time will still normally be recorded as the difference between (6) and (7). Any apparent discrepancies caused by mixed action between different persons should be made clear under "Remarks."
9. { Should be taken literally and do not necessarily apply to the person  
and { designated in line (6).  
10. {

11. Refers to the first man who actually does work on the fire, whether a Forest Service employee or an outsider.
  12. Refers to men who arrive at the fire subsequent to the arrival of the first man, including overhead as well as laborers.
  13. Elapsed time should be computed from the time the first men started work, and in some situations might be difference between 11 and 13 rather than 7 and 13.
  14. Similar to 13.
  16. In maximum number of men include all persons actively participating in suppression of the fire whether on or off shift but excluding office and warehouse overhead unless specifically hired for the particular fire at hand. A District Ranger or other Forest Officer inspecting the fire is engaged on the fire.
- Following is a hypothetical case :

1. Fire started 3/20; 2:00 P.M.
  2. First discovered by District Ranger, 30 miles distant, 3/21; 1:30 P.M.
  3. Next sighted by *landowner* 300 feet distant 3/21; 1:40 P.M.
  4. Reported to.....landowner.....
  5. Report received by.....landowner.....
  6. Landowner left for fire 3/21; 1:40 P.M.
  7. Traveled 300 feet, arrived at fire 3/21; 1:41 P.M.
  8. No time lost hunting for fire.
- The District Ranger left for fire with one man 3/21; 3:30 P.M.; arrived on fire 5:30 P.M.

In filling out fire report using the above time elements, they should be interpreted as follows :

|  | Date    | Hour      | Elapsed Time |
|--|---------|-----------|--------------|
| 1. Time of origin.....   | 3/20/36 | 2:00 P.M. | xxx          |
| 2. First discovered (D.R.).....                                    | 3/21/36 | 1:30 P.M. | 23:30        |
| 3. Next sighted by landowner.....                                  | 3/21/36 | 1:40 P.M. | xxx          |
| 4. Reported to .....   | .....   | .....     | xxx          |
| 5. Report received by.....   | .....   | .....     | xxx          |
| 6. Landowner left for fire.....                                    | 3/21/36 | 1:40 P.M. | 0:00         |
| 7. Traveled 300 feet—arrived fire.....                             | 3/21/36 | 1:41 P.M. | 0:01         |
| 8. ....  | xxx     | xxx       | xxx          |
| 9. Origin to arrival first man.....                                | xxx     | xxx       | 23:41        |
| 10. First discovery to arrival.....                                | xxx     | xxx       | 0:01         |
| 11. Landowner started work.....                                    | 3/21/36 | 1:41 P.M. | 23:41        |
| 12. First reinforcements arrived<br>(2 men 3/21/36 5:30 P.M.)..... | xxx     | xxx       | 4:00         |



|                           |         |           |       |
|---------------------------|---------|-----------|-------|
| 13. Fire corralled .....  | 3/21/36 | 8:00 P.M. | 6:19  |
| 14. Fire controlled ..... | 3/21/36 | 9:00 P.M. | 7:19  |
| 15. Fire out .....        | 3/22/36 | 6:00 P.M. | 21:00 |

Remarks: District Ranger left station for fire with one man 3/21/36 at 3:30 P.M. Distance traveled 35 miles.

The above illustration is a guide when making out fire reports for "mixed action" fires and in computing elapsed time elements.

## APPENDIX 15

### OUTLINE FOR REPORT TO SPECIAL COOPERATORS

#### APPENDIX 15

REPORT OUTLINE TO BE FOLLOWED WHEN REPORTING FIRES ON LANDS OF:

RED RIVER LUMBER CO.  
SOUTHERN PACIFIC LAND CO.  
PACIFIC GAS & ELECTRIC CO.

FOREST \_\_\_\_\_ DATE \_\_\_\_\_

COMPANY \_\_\_\_\_ SEASON \_\_\_\_\_

| NAME   | CLASS | DATE | AREA | SEC. | T | R | TOTAL<br>FFF | F.O.<br>TIME | CCC | TOTAL<br>COST | TIMBER<br>DAM. | VALUE | CAUSE |
|--------|-------|------|------|------|---|---|--------------|--------------|-----|---------------|----------------|-------|-------|
|        |       |      |      |      |   |   |              |              |     |               |                |       |       |
|        |       |      |      |      |   |   |              |              |     |               |                |       |       |
|        |       |      |      |      |   |   |              |              |     |               |                |       |       |
| TOTALS |       |      |      |      |   |   |              |              |     |               |                |       |       |

#### SUMMARY BY CAUSES

| CAUSE            | CLASS |   |   | TOTALS |
|------------------|-------|---|---|--------|
|                  | A     | B | C |        |
| LIGHTENING       |       |   |   |        |
| CHILDREN (MATCH) |       |   |   |        |
| INCENDIARY       |       |   |   |        |
| ETC.             |       |   |   |        |
| TOTALS           |       |   |   |        |

## APPENDIX 16

### INSTRUCTIONS FOR PREPARATION OF FIRE ATLAS

#### DATE

All maps and tabulations will be brought up to date by February 15 each year.

#### BASE

Prepare volume of work, burned area, fires by causes, maps on mounted 1/4-inch bases. The others will be on the bases set for the specific plans.

#### PERIOD

Ten-year intervals—1931-1940, 1941-1950, etc.

## MAPS

### a. *Volume of Work*

Plot the starting point of each fire, using one symbol for both A's and B's and another for C fires. At the end of each period zone the occurrence of fires and the percentage of C's:

*Zones*, in different colors for

More than 4 fires per 1,000 acres

1 to 4 fires per 1,000 acres

Less than 1 fire per 1,000 acres

No fires uncolored.

### *Percentage of C's*

Use perpendicular cross-hatch for areas having 20-40% C's.

Use horizontal cross-hatch for areas over 40% C's.

Leave areas under 20% alone.

### b. *Burned Area*

Outline in different colors by years all fires over 40 acres in area.

### c. *Fires by Causes*

Make a separate map for each major cause, although two classes of fires can be shown on the same base if not too numerous or overlapping. Make separate maps for lightning and smokers. Cover also, camper, incendiary, railroads or any other major causes.

Show C's by one symbol and A's and B's by another. Use different colored inks for each five-year period. Outline each zone lightly in pencil after each year's entry, inking these in at the end of the period and tinting lightly.

### d. *Hour Control*

Cross refer to the maps made in the Transportation Study. Bring these up to date as often as material changes in transportation or man-power make this necessary.

### e. *Visible Area Maps*

As changes in the lookout system are made, addition to or elimination from the master visible area map should be made. Cross refer in atlas to the detection map file, since it is impracticable to bind these in the atlas.

### f. *Communication and Transportation Plans*

Cross refer in the atlas to the file on such plans.

### g. *Risk and Hazard Reduction Plans*

File as part of the atlas when completed and bring up to date annually.

### h. *Sheets A-N and Forms 924*

Keep in binders as part of the Fire Atlas.



Be sure titles and comprehensive legends are put on all maps. Initial and date to identify preparation and revision.

Special instructions will be issued if at any time the Regional Forester wants any portion of the Forest Atlas sent in to him for copying.

APPENDIX 17  
AREA-PERIMETER TABLE

APPENDIX 17

Perimeter of fire corresponding with area enclosed by it.

Perimeter is shown in linear units of the same kind as the square units used for area.  
If area is in square chains, perimeter is in chains.

| Area  | Minimum 1/<br>perimeter<br>1 C | Probable 2/<br>perimeter<br>1.5 C | Maximum 3/<br>perimeter<br>2 C | Area | Minimum<br>perimeter<br>1 C | Probable<br>perimeter<br>1.5 C | Maximum<br>perimeter<br>2 C |
|-------|--------------------------------|-----------------------------------|--------------------------------|------|-----------------------------|--------------------------------|-----------------------------|
| 1     | 3.5                            | 5.25                              | 7.00                           | 210  | 51.4                        | 77.10                          | 102.80                      |
| 2     | 5.0                            | 7.50                              | 10.00                          | 220  | 52.5                        | 78.75                          | 105.00                      |
| 3     | 6.1                            | 9.15                              | 12.20                          | 230  | 53.7                        | 80.55                          | 107.40                      |
| 4     | 7.1                            | 10.65                             | 14.20                          | 240  | 54.8                        | 82.20                          | 109.60                      |
| 5     | 8.0                            | 12.00                             | 16.00                          | 250  | 56.0                        | 84.00                          | 112.00                      |
| 6     | 8.7                            | 13.05                             | 17.40                          | 260  | 57.1                        | 85.65                          | 114.20                      |
| 7     | 9.4                            | 14.10                             | 18.80                          | 270  | 58.3                        | 87.45                          | 116.60                      |
| 8     | 10.0                           | 15.00                             | 20.00                          | 280  | 59.4                        | 89.10                          | 118.80                      |
| 9     | 10.6                           | 15.90                             | 21.20                          | 290  | 60.4                        | 90.60                          | 120.80                      |
| 10    | 11.2                           | 16.80                             | 22.40                          | 300  | 61.5                        | 92.25                          | 123.00                      |
| 11    | 11.7                           | 17.55                             | 23.40                          | 320  | 63.4                        | 95.10                          | 126.80                      |
| 12    | 12.3                           | 18.45                             | 24.60                          | 340  | 65.4                        | 98.10                          | 130.80                      |
| 13    | 12.8                           | 19.20                             | 25.60                          | 360  | 67.2                        | 100.80                         | 134.40                      |
| 14    | 13.2                           | 19.80                             | 26.40                          | 380  | 69.1                        | 103.65                         | 138.20                      |
| 15    | 13.7                           | 20.55                             | 27.40                          | 400  | 70.9                        | 106.35                         | 141.80                      |
| 16    | 14.2                           | 21.30                             | 28.40                          | 425  | 73.1                        | 109.65                         | 146.20                      |
| 17    | 14.6                           | 21.90                             | 29.20                          | 450  | 75.2                        | 112.80                         | 150.40                      |
| 18    | 15.1                           | 22.65                             | 30.20                          | 475  | 77.2                        | 115.80                         | 154.40                      |
| 19    | 15.5                           | 23.25                             | 31.00                          | 500  | 79.3                        | 118.95                         | 158.60                      |
| 20.0  | 15.9                           | 23.85                             | 31.80                          | 550  | 83.2                        | 124.80                         | 166.40                      |
| 22.5  | 16.8                           | 25.20                             | 33.60                          | 600  | 86.8                        | 130.20                         | 173.60                      |
| 25.0  | 17.7                           | 26.55                             | 35.40                          | 650  | 90.4                        | 135.60                         | 180.80                      |
| 27.5  | 18.6                           | 27.90                             | 37.20                          | 700  | 93.7                        | 140.55                         | 187.40                      |
| 30.0  | 19.4                           | 29.10                             | 38.80                          | 750  | 97.0                        | 145.50                         | 194.00                      |
| 32.5  | 20.3                           | 30.45                             | 40.60                          | 800  | 100.2                       | 150.30                         | 200.40                      |
| 35.0  | 21.0                           | 31.50                             | 42.00                          | 850  | 103.4                       | 155.10                         | 206.80                      |
| 37.5  | 21.7                           | 32.55                             | 43.40                          | 900  | 106.3                       | 159.45                         | 212.60                      |
| 40.0  | 22.4                           | 33.60                             | 44.80                          | 950  | 109.3                       | 163.95                         | 218.60                      |
| 42.5  | 23.2                           | 34.80                             | 46.40                          | 1000 | 112.1                       | 168.15                         | 224.20                      |
| 45.0  | 23.7                           | 35.55                             | 47.40                          | 1050 | 114.8                       | 172.20                         | 229.60                      |
| 47.5  | 24.5                           | 36.75                             | 49.00                          | 1100 | 117.5                       | 176.25                         | 235.00                      |
| 50.0  | 25.0                           | 37.50                             | 50.00                          | 1150 | 120.2                       | 180.30                         | 240.40                      |
| 52.5  | 25.8                           | 38.70                             | 51.60                          | 1200 | 122.8                       | 184.20                         | 245.60                      |
| 55.0  | 26.3                           | 39.45                             | 52.60                          | 1250 | 125.4                       | 188.10                         | 250.80                      |
| 57.5  | 26.8                           | 40.20                             | 53.60                          | 1300 | 127.8                       | 191.70                         | 255.60                      |
| 60.0  | 27.5                           | 41.25                             | 55.00                          | 1350 | 130.3                       | 195.45                         | 260.60                      |
| 65.0  | 28.6                           | 42.90                             | 57.20                          | 1400 | 132.6                       | 198.90                         | 265.20                      |
| 70.0  | 29.7                           | 44.55                             | 59.40                          | 1450 | 134.9                       | 202.35                         | 269.80                      |
| 75.0  | 30.7                           | 46.05                             | 61.40                          | 1500 | 137.3                       | 205.95                         | 274.60                      |
| 80.0  | 31.7                           | 47.55                             | 63.40                          | 1550 | 139.6                       | 209.40                         | 279.20                      |
| 85.0  | 32.6                           | 48.90                             | 65.20                          | 1600 | 141.8                       | 212.70                         | 283.60                      |
| 90.0  | 33.6                           | 50.40                             | 67.20                          | 1650 | 144.0                       | 216.00                         | 288.00                      |
| 95.0  | 34.6                           | 51.90                             | 69.20                          | 1700 | 146.1                       | 219.15                         | 292.20                      |
| 100.0 | 35.5                           | 53.25                             | 71.00                          | 1750 | 148.3                       | 222.45                         | 296.60                      |
| 110.0 | 37.2                           | 55.80                             | 74.40                          | 1800 | 150.4                       | 225.60                         | 300.80                      |
| 120.0 | 38.7                           | 58.05                             | 77.40                          | 1850 | 152.5                       | 228.75                         | 305.00                      |
| 130.0 | 40.4                           | 60.60                             | 80.80                          | 1900 | 154.6                       | 231.90                         | 309.20                      |
| 140.0 | 41.9                           | 62.85                             | 83.80                          | 1950 | 156.5                       | 234.75                         | 313.00                      |
| 150.0 | 43.3                           | 64.95                             | 86.60                          | 2000 | 158.6                       | 237.90                         | 317.20                      |
| 160.0 | 44.8                           | 67.20                             | 89.60                          | 2050 | 160.5                       | 240.75                         | 321.00                      |
| 170.0 | 46.2                           | 69.30                             | 92.40                          | 2100 | 162.5                       | 243.75                         | 325.00                      |
| 180.0 | 47.5                           | 71.25                             | 95.00                          | 2150 | 164.4                       | 246.60                         | 328.80                      |
| 190.0 | 48.8                           | 73.20                             | 97.60                          | 2200 | 166.3                       | 249.45                         | 332.60                      |
| 200.0 | 50.2                           | 75.30                             | 100.40                         |      |                             |                                |                             |

1/ Perimeter is that of a circle corresponding with the area.  
2/ Perimeter is 1.5 times that of a circle corresponding with the area.  
3/ Perimeter is 2.0 times that of a circle corresponding with the area.

Appendix 17 - Cont.  
Perimeter of fire corresponding with area enclosed by it.

Perimeter is shown in linear units of the same kind as the square units used for area.  
 If area is in square feet, perimeter is in feet.

| Area    | Minimum 1/<br>perimeter<br>1 C | Probable 2/<br>perimeter<br>1.5 C | Maximum 3/<br>perimeter<br>2 C | Area    | Minimum<br>perimeter<br>1 C | Probable<br>perimeter<br>1.5 C | Maximum<br>perimeter<br>2 C |
|---------|--------------------------------|-----------------------------------|--------------------------------|---------|-----------------------------|--------------------------------|-----------------------------|
| 2,000   | 159                            | 238                               | 318                            | 102,000 | 1132                        | 1698                           | 2264                        |
| 4,000   | 222                            | 334                               | 445                            | 104,000 | 1144                        | 1716                           | 2288                        |
| 6,000   | 270                            | 405                               | 540                            | 106,000 | 1154                        | 1731                           | 2308                        |
| 8,000   | 317                            | 476                               | 635                            | 108,000 | 1165                        | 1747                           | 2330                        |
| 10,000  | 355                            | 532                               | 710                            | 110,000 | 1175                        | 1762                           | 2350                        |
| 12,000  | 388                            | 581                               | 775                            | 112,000 | 1185                        | 1777                           | 2370                        |
| 14,000  | 417                            | 626                               | 835                            | 114,000 | 1196                        | 1794                           | 2392                        |
| 16,000  | 447                            | 670                               | 893                            | 116,000 | 1206                        | 1810                           | 2413                        |
| 18,000  | 475                            | 712                               | 950                            | 118,000 | 1216                        | 1824                           | 2432                        |
| 20,000  | 500                            | 750                               | 1000                           | 120,000 | 1226                        | 1839                           | 2452                        |
| 22,000  | 525                            | 787                               | 1050                           | 122,000 | 1236                        | 1854                           | 2472                        |
| 24,000  | 550                            | 825                               | 1100                           | 124,000 | 1246                        | 1869                           | 2492                        |
| 26,000  | 574                            | 861                               | 1148                           | 126,000 | 1257                        | 1885                           | 2514                        |
| 28,000  | 595                            | 892                               | 1190                           | 128,000 | 1266                        | 1899                           | 2532                        |
| 30,000  | 615                            | 922                               | 1230                           | 130,000 | 1275                        | 1912                           | 2550                        |
| 32,000  | 635                            | 952                               | 1270                           | 132,000 | 1286                        | 1929                           | 2572                        |
| 34,000  | 655                            | 982                               | 1310                           | 134,000 | 1295                        | 1942                           | 2590                        |
| 36,000  | 675                            | 1012                              | 1350                           | 136,000 | 1305                        | 1957                           | 2610                        |
| 38,000  | 692                            | 1039                              | 1385                           | 138,000 | 1315                        | 1972                           | 2630                        |
| 40,000  | 710                            | 1065                              | 1420                           | 140,000 | 1324                        | 1986                           | 2648                        |
| 42,000  | 727                            | 1091                              | 1455                           | 142,000 | 1334                        | 2001                           | 2668                        |
| 44,000  | 745                            | 1117                              | 1490                           | 144,000 | 1343                        | 2014                           | 2686                        |
| 46,000  | 762                            | 1144                              | 1525                           | 146,000 | 1351                        | 2026                           | 2702                        |
| 48,000  | 778                            | 1168                              | 1557                           | 148,000 | 1360                        | 2040                           | 2720                        |
| 50,000  | 794                            | 1191                              | 1588                           | 150,000 | 1370                        | 2055                           | 2740                        |
| 52,000  | 810                            | 1215                              | 1620                           | 152,000 | 1379                        | 2068                           | 2758                        |
| 54,000  | 825                            | 1237                              | 1650                           | 154,000 | 1387                        | 2081                           | 2775                        |
| 56,000  | 840                            | 1260                              | 1680                           | 156,000 | 1396                        | 2094                           | 2792                        |
| 58,000  | 855                            | 1282                              | 1710                           | 158,000 | 1405                        | 2107                           | 2810                        |
| 60,000  | 870                            | 1305                              | 1740                           | 160,000 | 1413                        | 2119                           | 2826                        |
| 62,000  | 885                            | 1327                              | 1770                           | 162,000 | 1422                        | 2134                           | 2845                        |
| 64,000  | 899                            | 1348                              | 1798                           | 164,000 | 1431                        | 2146                           | 2862                        |
| 66,000  | 912                            | 1369                              | 1825                           | 166,000 | 1440                        | 2160                           | 2880                        |
| 68,000  | 926                            | 1390                              | 1853                           | 168,000 | 1449                        | 2173                           | 2898                        |
| 70,000  | 940                            | 1410                              | 1880                           | 170,000 | 1456                        | 2184                           | 2912                        |
| 72,000  | 953                            | 1429                              | 1905                           | 172,000 | 1465                        | 2197                           | 2930                        |
| 74,000  | 966                            | 1450                              | 1933                           | 174,000 | 1474                        | 2211                           | 2948                        |
| 76,000  | 979                            | 1468                              | 1958                           | 176,000 | 1481                        | 2221                           | 2962                        |
| 78,000  | 992                            | 1488                              | 1984                           | 178,000 | 1490                        | 2235                           | 2980                        |
| 80,000  | 1004                           | 1506                              | 2008                           | 180,000 | 1499                        | 2248                           | 2998                        |
| 82,000  | 1016                           | 1524                              | 2032                           | 182,000 | 1508                        | 2262                           | 3016                        |
| 84,000  | 1028                           | 1543                              | 2057                           | 184,000 | 1516                        | 2274                           | 3032                        |
| 86,000  | 1040                           | 1560                              | 2080                           | 186,000 | 1525                        | 2287                           | 3050                        |
| 88,000  | 1052                           | 1579                              | 2105                           | 188,000 | 1537                        | 2306                           | 3075                        |
| 90,000  | 1064                           | 1596                              | 2128                           | 190,000 | 1544                        | 2311                           | 3082                        |
| 92,000  | 1075                           | 1612                              | 2150                           | 192,000 | 1550                        | 2325                           | 3100                        |
| 94,000  | 1087                           | 1631                              | 2175                           | 194,000 | 1559                        | 2338                           | 3118                        |
| 96,000  | 1099                           | 1648                              | 2198                           | 196,000 | 1566                        | 2349                           | 3132                        |
| 98,000  | 1110                           | 1665                              | 2220                           | 198,000 | 1575                        | 2362                           | 3150                        |
| 100,000 | 1121                           | 1681                              | 2242                           | 200,000 | 1581                        | 2371                           | 3162                        |

- 1/ Perimeter is that of a circle corresponding with the area.  
 2/ Perimeter is 1.5 times that of a circle corresponding with the area.  
 3/ Perimeter is 2.0 times that of a circle corresponding with the area.



# APPENDIX 18

## MAN-POWER NEEDS WORK SHEET

APPENDIX 18

PAGE 1

MAN-POWER NEEDS

WORK SHEET FOR DETERMINING MAN-POWER, SPECIALIST & OVERHEAD NEEDS TO CONTROL FIRE DURING ONE BURNING PERIOD

|               |  |  |  |  |  |  |  |  |  |  |  |  |        |
|---------------|--|--|--|--|--|--|--|--|--|--|--|--|--------|
| DIVISIONS     |  |  |  |  |  |  |  |  |  |  |  |  | TOTALS |
| SECTORS       |  |  |  |  |  |  |  |  |  |  |  |  |        |
| SECTOR BOSS   |  |  |  |  |  |  |  |  |  |  |  |  |        |
| CREW BOSSES   |  |  |  |  |  |  |  |  |  |  |  |  |        |
| FIRE FIGHTERS |  |  |  |  |  |  |  |  |  |  |  |  |        |
| FALLERS       |  |  |  |  |  |  |  |  |  |  |  |  |        |
| OPERATORS     |  |  |  |  |  |  |  |  |  |  |  |  |        |
| TRAILBLDRS.   |  |  |  |  |  |  |  |  |  |  |  |  |        |
| TRUCK-TANK    |  |  |  |  |  |  |  |  |  |  |  |  |        |
| PORT. PUMP    |  |  |  |  |  |  |  |  |  |  |  |  |        |
| MESSENGERS    |  |  |  |  |  |  |  |  |  |  |  |  |        |
|               |  |  |  |  |  |  |  |  |  |  |  |  |        |
| DIVISION BOSS |  |  |  |  |  |  |  |  |  |  |  |  |        |
| LINE INSPTRS. |  |  |  |  |  |  |  |  |  |  |  |  |        |
| CAMP BOSSES   |  |  |  |  |  |  |  |  |  |  |  |  |        |
| TRANSPTN. MEN |  |  |  |  |  |  |  |  |  |  |  |  |        |
| PACKERS       |  |  |  |  |  |  |  |  |  |  |  |  |        |
| RADIO OPERS.  |  |  |  |  |  |  |  |  |  |  |  |  |        |

NOTE: SIMILAR FORMS MAY BE USED FOR DETERMINATION OF TOOLS, EQUIPMENT, AND SUPPLIES NEEDS

FOREST

NAME OF FIRE

DATE

SIGNATURE

SEE REVERSE SIDE FOR MAPPING WORK SHEET

MAPPING WORK SHEET

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |



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